WATTLE RESEARCH INSTITUTE
28 MAY 1956
UNIVERSITY OF NATAL, P.M.B.

AGRICULTURAL *Chemicals*

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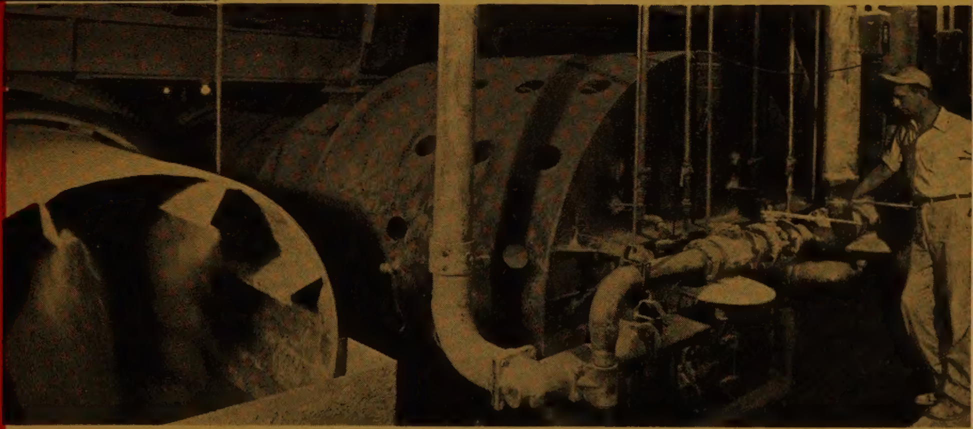
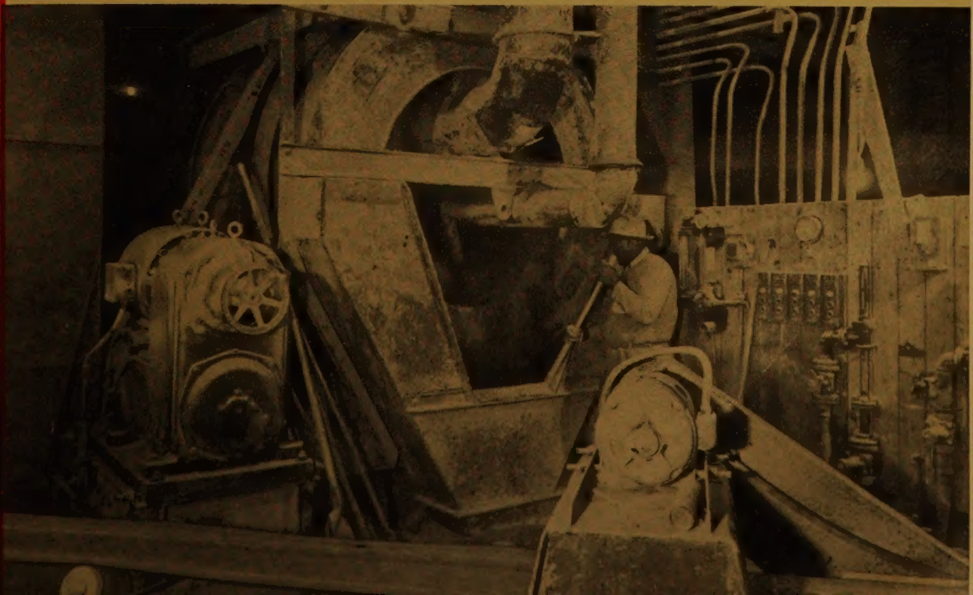




April, 1956

Heavy Shipping Period

Each year the movement of fertilizer contracts into a shorter shipping period.

Only by working every day of the year are we able to meet this peak season demand.

When quick potash shipments are required to keep your plants manufacturing at top speed, call on PCA, whose facilities are geared to your needs.

P.C.A.
"The SALT of the EARTH"
RED MURIATE

CALL ON US FOR YOUR POTASH NEEDS

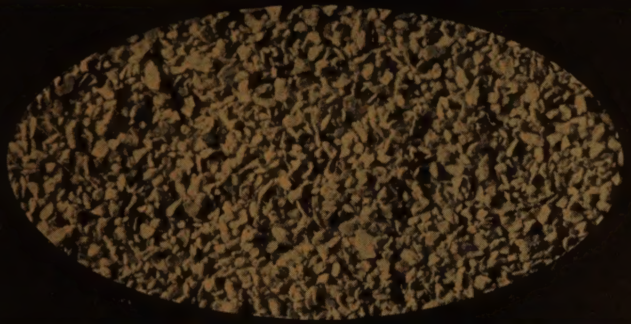
POTASH COMPANY OF AMERICA
CARLSBAD, NEW MEXICO.

General Sales Office . . . 1625 Eye Street, N.W., Washington, D.C.
Midwestern Sales Office . . . First National Bank Bldg., Peoria, Ill.
Southern Sales Office . . . Candler Building, Atlanta, Ga.

Corn Growers with borers to kill . . .

Dealers with growers to satisfy . . .

Formulators with dealers to serve . . .



All specify

GRANULAR ATTACLAY®

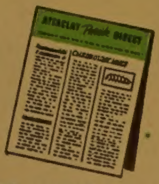
Granular Attaclay—the original, pioneer carrier—imparts definite points of superiority to the new, approved granular pesticides for corn borer control.

Aid To Processors—Granular Attaclay is a clean-cut, quality-controlled product. It is highly sorptive . . . combines ideally with toxicants . . . resists breakdown. It's available in 5 mesh sizes. Its particles are highly uniform. It fits across-the-board in herbicides, fungicides, soil fumigants.

Dealers Benefit, Too—they're on safe ground with growers when 95% by weight of the finished pesticide is the reliable product of a major, pioneer supplier of insecticide carriers.

Pay-Off For Corn Growers—who get the following advantages: excellent kill; greater safety; no clog; easy to apply; almost no drift, large "pay load", no caking; no water hauling; no chance for error in mixing; ability to *see* granules in the corn plant, dead borers in the whorl. Granular Attaclay stays where it is put and does the job.

Here's Help For You—brand-new edition of Pesticide Digest filled with facts about borer control and granular pesticides; samples; technical help. Use the coupon now.



ATTAPULGUS PRODUCTS *from*

MINERALS & CHEMICALS CORPORATION OF AMERICA
9 ESSEX TURNPIKE, MENLO PARK, NEW JERSEY

ALWAYS A BETTER WAY . . .

MINERALS & CHEMICALS CORPORATION OF AMERICA
9 Essex Turnpike, Menlo Park, N.J.

Please send me:

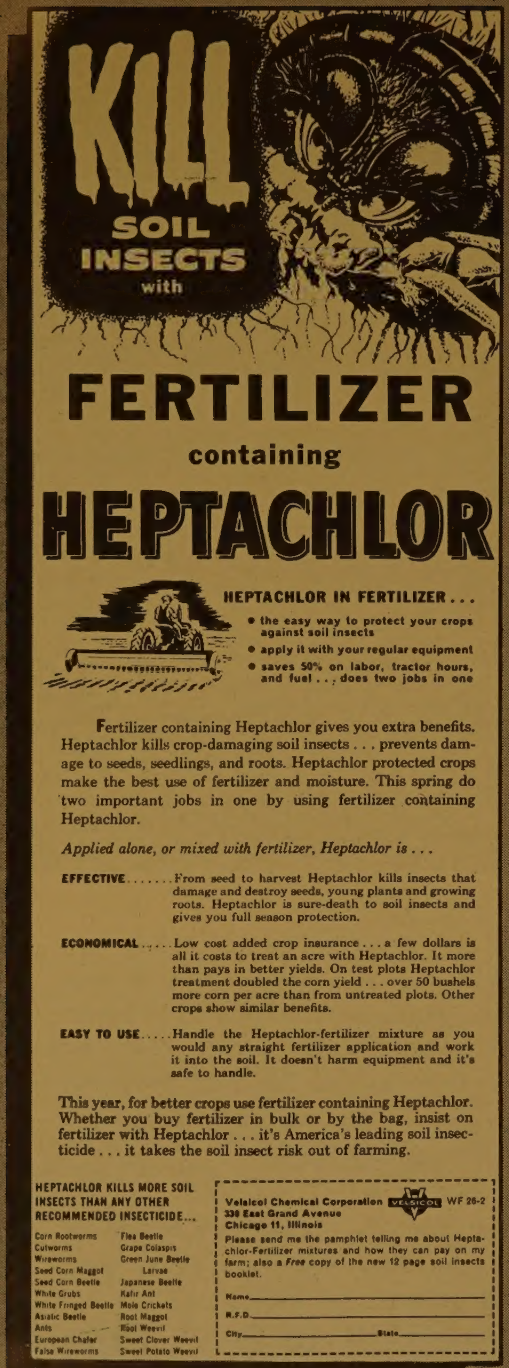
☐ Pesticide Digest on corn borers
☐ Samples of Granular Attaclay for following applications

name ____________________ title ____________

company ____________________

address ____________________

city ____________ zone ______ state ______



KILL
SOIL INSECTS
with

FERTILIZER
containing
HEPTACHLOR

HEPTACHLOR IN FERTILIZER . . .

- the easy way to protect your crops against soil insects
- apply it with your regular equipment
- saves 50% on labor, tractor hours, and fuel . . . does two jobs in one

Fertilizer containing Heptachlor gives you extra benefits. Heptachlor kills crop-damaging soil insects . . . prevents damage to seeds, seedlings, and roots. Heptachlor protected crops make the best use of fertilizer and moisture. This spring do two important jobs in one by using fertilizer containing Heptachlor.

Applied alone, or mixed with fertilizer, Heptachlor is . . .

EFFECTIVE.......From seed to harvest Heptachlor kills insects that damage and destroy seeds, young plants and growing roots. Heptachlor is sure-death to soil insects and gives you full season protection.

ECONOMICAL.....Low cost added crop insurance . . . a few dollars is all it costs to treat an acre with Heptachlor. It more than pays in better yields. On test plots Heptachlor treatment doubled the corn yield . . . over 50 bushels more corn per acre than from untreated plots. Other crops show similar benefits.

EASY TO USE.....Handle the Heptachlor-fertilizer mixture as you would any straight fertilizer application and work it into the soil. It doesn't harm equipment and it's safe to handle.

This year, for better crops use fertilizer containing Heptachlor. Whether you buy fertilizer in bulk or by the bag, insist on fertilizer with Heptachlor . . . it's America's leading soil insecticide . . . it takes the soil insect risk out of farming.

HEPTACHLOR KILLS MORE SOIL INSECTS THAN ANY OTHER RECOMMENDED INSECTICIDE...

Corn Rootworms
Cutworms
Wireworms
Seed Corn Maggot
Seed Corn Beetle
White Grubs
White Fringed Beetle
Asiatic Beetle
Ants
European Chafer
False Wireworms
Flea Beetle
Grape Colaspis
Green June Beetle Larvae
Japanese Beetle
Kafir Ant
Mole Crickets
Root Maggot
Root Weevil
Sweet Clover Weevil
Sweet Potato Weevil

Velsicol Chemical Corporation VELSICOL WF 26-2
330 East Grand Avenue
Chicago 11, Illinois

Please send me the pamphlet telling me about Heptachlor-Fertilizer mixtures and how they can pay on my farm; also a *Free* copy of the new 12 page soil insects booklet.

Name________________
R.F.D.________________
City____________State________

Advertisement now appearing in farm publications

VELSICOL

Everybody is reading about

HEPTACHLOR -FERTILIZER

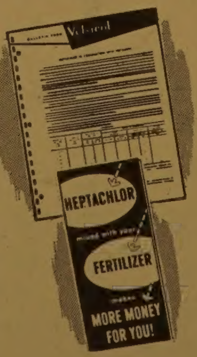
Mixtures

Another PROFIT PLUS for Heptachlor formulators, distributors and fertilizer manufacturers

Over a million farmers are regularly reading about Heptachlor-Fertilizer mixtures in farm magazines and state farm papers. And many more thousands will be hearing the Heptachlor-with-Fertilizer facts on leading farm radio stations. Dealers are reading about this new profit opportunity in *Croplife* magazine and are the target of our strong direct mail program. In addition, Velsicol sales personnel are presenting the Heptachlor story to hundreds of dealers each month.

More farmers will buy Heptachlor for soil insect protection this spring than ever before. They'll ask for Heptachlor mixed with Fertilizer. For greater sales, take advantage of the coming demand for this more effective combination—push Heptachlor-Fertilizer mixtures.

HEPTACHLOR IS AMERICA'S LEADING SOIL INSECTICIDE!



Velsicol Chemical Corporation AC-46
330 East Grand Avenue
Chicago 11, Illinois

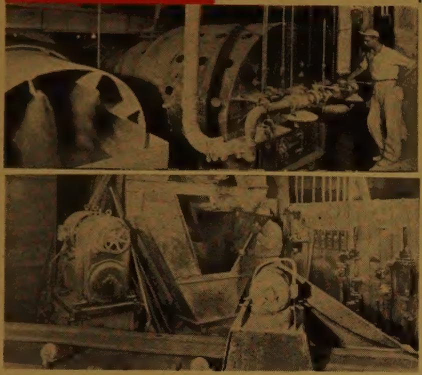
Please send me the following without charge . . .

________copies of the sales-aid folder to tell farmers the complete facts on Heptachlor-Fertilizer mixtures.

________copies of Technical Bulletin #504-8 explaining new, simpler, lower cost methods of making Heptachlor-Fertilizer mixtures.

NAME________________
COMPANY________________
STREET AND NUMBER________________
CITY____________ZONE______STATE________

AGRICULTURAL *Chemicals*



Granulation and ammoniation at Fertilizer Manufacturing Cooperative, Inc., Baltimore, Md. See story pages 40-41.

Top Photo: View of A. J. Sackett combustion chamber, drier and cooler.

Bottom Photo: Ammoniator showing the slurry rolling out. Conveyor takes oversize from classifying screen to dryer.

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PUBLISHED monthly on the 1st by Industry Publications, Inc.

ADVERTISING and Editorials office, P. O. Box 31, Caldwell, New Jersey.

PUBLICATION Office: 123 Market Pl., Baltimore, Md.

ENTERED as second-class matter November 4, 1949 at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

SUBSCRIPTION RATES: United States, 1 year, $3.00; 2 years, $5.00. Canada and Pan American countries, 1 year, $4.00; 2 years, $7.00. All other foreign countries, 1 year, $9.00; 2 years, $15.

SINGLE COPIES: current issue: $0.50; all back numbers $1.00. Postage and handling charges for foreign countries on single copies: $1.00. Claims for missing numbers will not be allowed if received more than 60 days from date of mailing. No claims allowed from subscribers arising from failure to notify the Circulation department of a change of address, or because a copy is "missing from files."

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Again we tell 3½ million farmers

Fertilizer Grows Farm Profits

Fertilizer is the best help the farmer can get today. It helps him grow bigger yields of cash crops on fewer acres at lower cost, thus assuring a greater return from labor, machinery and other fixed expenses. It also helps his soil-building crops do a better job of soil improvement on acres taken out of cash crops and put into acreage reserve.

The importance of fertilizer to the farmer is being brought to the attention of 3½ MILLION readers of farm magazines by a powerful and continuing campaign conducted by Nitrogen Division, Allied Chemical & Dye Corporation.

Shown on the opposite page is one in a series of big, full-page advertisements appearing in farm magazines. Others have preceded it and more will follow. We trust that this campaign is helpful to you and we will greatly appreciate any comments or suggestions you may wish to send us.

Money-making deposit in your SOIL BANK

If you are faced with the problem of making a profit out of growing your cash crops on fewer acres this year—*fertilizer is the best help you can get!* If you are taking part of your land out of production and planting this to soil-building crops that prevent erosion and build humus and fertility in the soil for future use—*fertilizer is the best help you can get!*

On cash crops, more fertilizer per acre means more yield per acre added to your crop at very low extra cost. This reduces your cost of production and greatly increases your net profit. The extra yields added by more fertilizer are the lowest cost and most profitable share of your crop. You are in better shape to make a good profit despite low crop prices and other conditions beyond your control.

On reserve acreage, fertilizer will help your legumes, grass and other soil-building crops do a far better job of soil improvement. Fertilizer produces a better stand with less seed and encourages vigorous root and top growth that adds fertility and organic matter to the soil and prevents erosion. Even windbreaks grow better with fertilizer. Fertilizer helps forest trees grow more rapidly and produce better yields of pulpwood and timber at an earlier date.

The price of fertilizer has not gone up like the prices of many other things you buy. Fertilizer is the most profitable investment you can make in growing cash crops! It's the best-paying deposit in your soil bank!

The fertilizer industry serves the farmer. Nitrogen Division serves the fertilizer industry as America's leading supplier of nitrogen for use in mixed fertilizers.

See Your County Agent

Ask your County Agent to recommend the analyses and the amounts of fertilizers best suited for your crops and soils. His advice to you is based on the latest official recommendations from your Extension Service and Experiment Station.

See Your Banker

Bankers are alert to good investments. They know that fertilizer pays a big return in bigger yields of better quality crops. If you need money to buy more fertilizer, talk it over with your banker.

See Your Dealer

Your fertilizer dealer can supply you with a good brand of fertilizer in the amounts and analyses as recommended by your County Agent. Help your dealer to get your fertilizer to you on time by placing your order early and accepting prompt delivery. It pays to have your fertilizer on hand when you need it. Remember, fertilizer grows farm profits. *Make sure you use enough this year!*

NITROGEN DIVISION Allied Chemical & Dye Corporation
40 Rector St., New York 6, N. Y.
Ironton, Ohio • Indianapolis 20, Ind. • Omaha 7, Neb.
St. Paul 4, Minn. • Kalamazoo, Mich. • Columbia, Mo.

Fertilizer Grows Farm Profits

What are Your Fertilizer Plant Design Requirements?

PHOSPHORIC ACID

Dorr-Oliver designs plants for producing strong acid (32 to 33% P_2O_5) directly by its well-known process using the revolutionary new Dorr-Oliver Traveling Pan Filter.

DIAMMONIUM PHOSPHATE BASED COMPOUNDS

Dorr-Oliver designs plants producing directly from 32% P_2O_5 phosphoric acid a wide variety of compounds such as 14-14-14, 14-28-14, 12-36-12, 11-48-0, 16-20-0 and 18-48-0 as hard, uniform, free-flowing granules based on mono or diammonium phosphates.

PHOSPHORIC ACID EVAPORATION

Dorr-Oliver designed vacuum evaporator stations eliminate serious scaling, reduce P_2O_5 losses to a negligible point and involve no fume problem.

TRIPLE SUPERPHOSPHATE FOR DIRECT APPLICATION

Dorr-Oliver designs plants to produce hard, uniform, free-flowing granules by its own process requiring evaporation to only 38% P_2O_5 with no need for subsequent curing.

NON-GRANULAR TRIPLE SUPERPHOSPHATE

Dorr-Oliver designs plants for producing a soft triple superphosphate with optimum characteristics for mixing and ammoniation.

Dorr-Oliver has had 40 years' experience in the field of concentrated fertilizer production via the wet process of manufacturing phosphoric acid. Dorr-Oliver designs and builds complete plants.

Let us send an engineer to discuss your requirements.

MIXING AND GRANULATION

Dorr-Oliver designs plants for producing compounds in the form of hard, uniform, free-flowing granules from a variety of raw materials in solid or liquid form.

DORRCO

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U. S. A.

DIAMOND insecticides and herbicides are known for dependable potency

We make sure of it here

Diamond's research and development center in Painesville, Ohio

So you can count on peak performance here

Write for literature on any of our products, and feel free to consult our technical staff when you have special problems. Your inquiries are welcome. DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS

Diamond Chemicals

DIAMOND AGRICULTURAL CHEMICALS

- DDT
- BHC
- LINDANE
- MITICIDE K-101 (Ovex)
- Seed Disinfectant
- 2,4-D Weed Killers
- 2,4,5-T Brush Killers
- Grain Fumigants
- Wettable powders, emulsifiable and oil solutions; and dust concentrates based on our technical grade chemicals

and many other chemicals that help farmers, gardeners, cattlemen and orchardists.

In the Spotlight this Month

- Slow rate of release of ammonia from resistant organic matter is the bottleneck in reactions taking place in the change from soil humus to nitrate. Page 46.

- Investigations of the phytotoxicity of solvents and emulsifiers used in insecticidal formulations show that the petroleum distillates are considerably more phytotoxic than other types of solvents; effective emulsifying agents are generally the more phytotoxic. Page 42.

- American Phytopathological Society Temporary Advisory Committee on Collecting and Disseminating Data on New Fungicide Tests completes third annual summary of results on recent fungicide, bactericide and nematocide trials. Page 57.

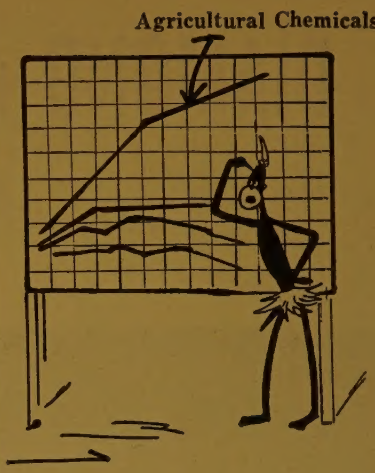
- Water insoluble materials, such as dicalcium phosphate, are more effective in powdered form than in granular form when applied separately, however, they become partially soluble and have greater agronomic efficiency in some granulated mixtures owing to their intimate contact with soluble salts in the granule. Page 35.

- Almost all cases of exposure to pesticides during harvesting have occurred where organic phosphates were used. An adequate safety period is essential in use of these pesticides. Page 49.

- "Ammonia is the lowest cost nitrogen form," reports E. Perrine, in a review of the economics and practices of ammoniation of granulated fertilizers. Page 51.

- Additional sulfuric acid aids granulation of low nitrogen grade fertilizers. Adjusting water content in material leaving ammoniator aids granulation of higher nitrogen grades. Page 40.

- Cotton industry appeals to NAC members for support in basic research on cotton plants, pointing out that "if cotton loses its competitive position, the agricultural chemicals industry loses its best customer." . . . Cost of developing a new successful agricultural chemical set at $1,200,000. . . . See Page 30.



Puzzled?

You may be puzzled about what the stock market will do . . . but there can be no question about what magazine to read.

Agricultural Chemicals offers you some 60 editorial pages each month, devoted to the technical and practical developments of the agricultural chemicals industry . . . a balanced distribution of articles and news of interest to the manufacturer and distributor of insecticides, fertilizers, herbicides, etc.

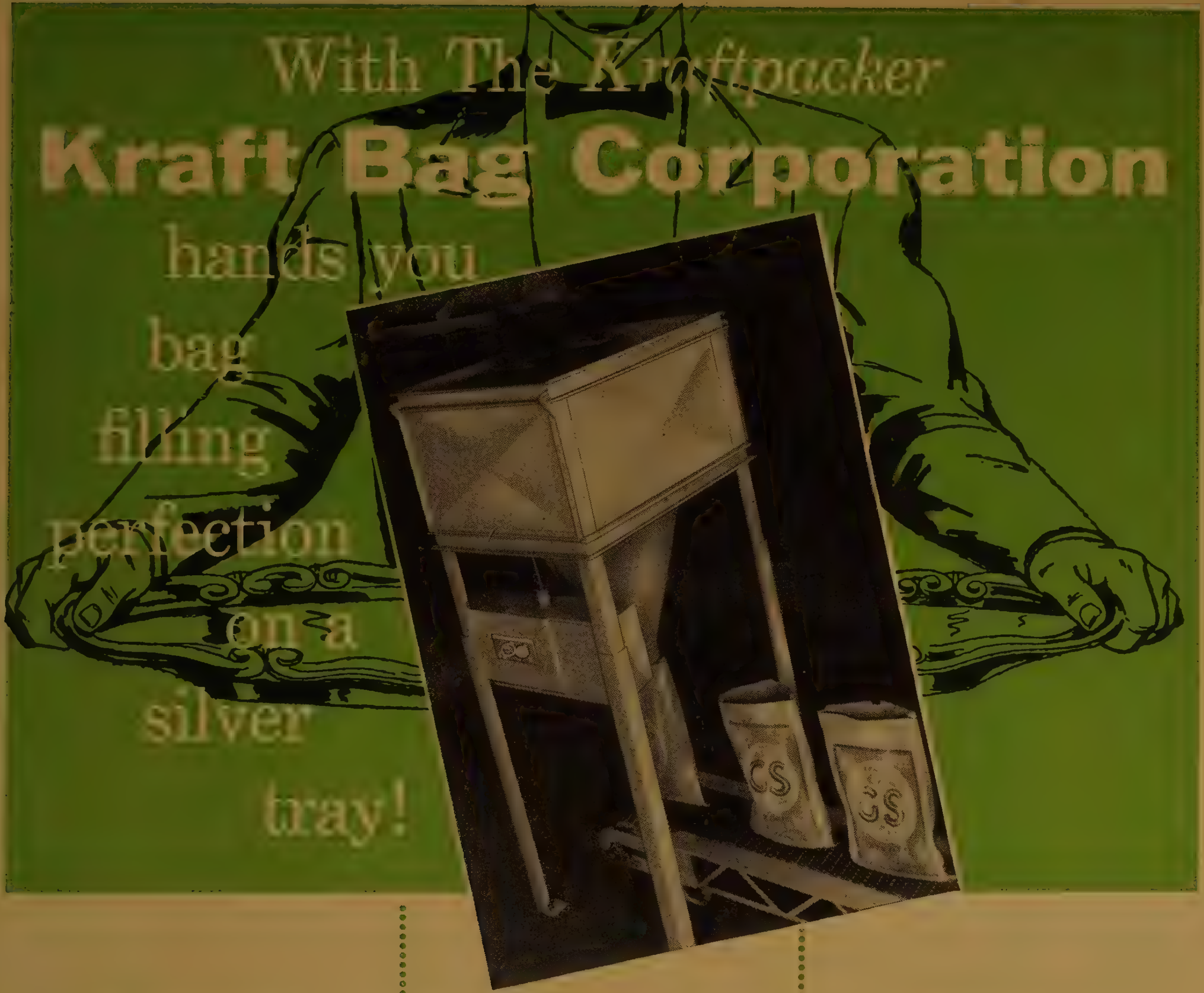
A technically trained staff is at YOUR service to edit, and interpret the information YOU are interested in—news, feature articles, meeting reports.

You can't afford not to be a subscriber. Send in the card bound in on page 35 to start getting your copies now!

•

AGRICULTURAL CHEMICALS

P. O. BOX 31
CALDWELL, NEW JERSEY



ACCURACY

The Kraftpacker guarantees an 8 oz. plus or minus tolerance—but actually delivers a daily average closer to 4 oz.!

HIGH PRODUCTION

Plants with Kraftpacker installations report filling 18 to 22 80 or 100 lb. charges a minute, with one man hanging bags—and a daily average of 40 tons per hour, with 10 to 12 change-overs.

SIMPLICITY

No automatic open mouth bag filling machine of its type will handle free-flowing material easier than The Kraftpacker. Reduces packaging costs at an unbelievable rate.

ECONOMY

The Kraftpacker is a proved money-saver in every way—costs less to buy, less to install, less to maintain.

and . . .

with Kraft Bag Corporation's integrated 2-plant multiwall bag manufacturing facilities, you have *everything* you need for your packaging operation, from one dependable source!

ACCURACY
kraftpacker
HIGH
PRODUCTION

Ask for representative . . . or brochure

KRAFT BAG CORPORATION

Gilman Paper Company Subsidiary
630 Fifth Ave., New York 20, N. Y.
Western Sales Office: Daily News Bldg., Chicago 6, Ill.

immediate delivery

Prentox Heptachlor

The versatile agricultural insecticide of the superior quality associated with the products sold by Prentiss.

PRENTOX HEPTACHLOR is a specific chemical agent for the control of alfalfa weevil, boll weevil, root worms and maggots, wireworms, and a long list of other agricultural pests.

PRENTOX HEPTACHLOR is now available for immediate shipment for use in your formulations. It is offered as a 25% wettable powder or a 2-lb. emulsion concentrate.

We invite your inquiries.

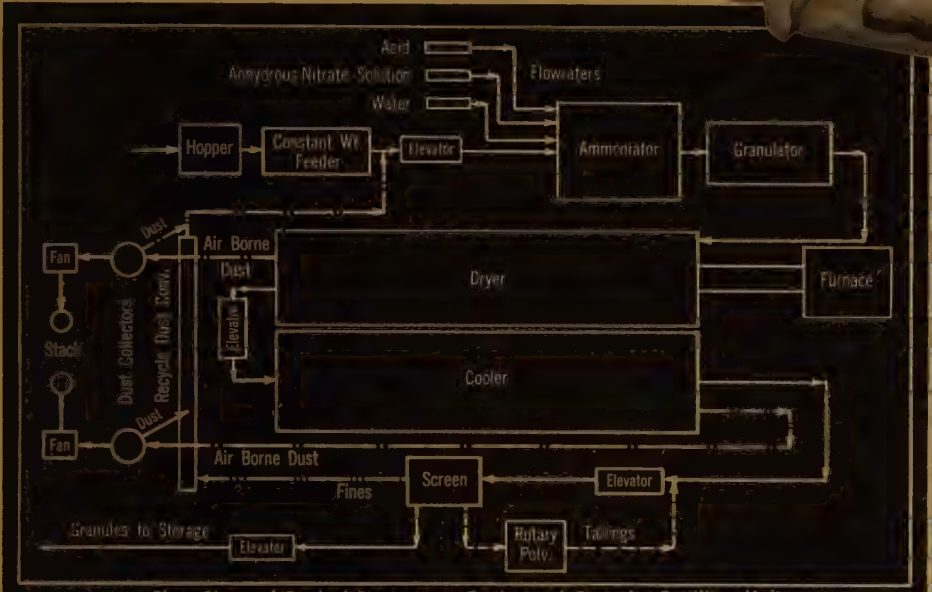
PRENTISS DRUG & CHEMICAL CO. INC. NEW YORK, N.Y.

PRENTISS pest-tested products you can count on:

Pyrethrum Products • Pyronyl Concentrate
DDT Concentrates • Toxaphene • Lindane • Chlordane Concentrates
Sabadilla • Rotenone • Warfarin

PRENTISS DRUG & CHEMICAL CO., INC.
110 William Street, New York 38, N. Y. • 9 South Clinton Street, Chicago 6, Illinois

Granular Fertilizer Can Be in Your Future, too!



Flow Sheet of Typical Sturtevant-Engineered Granular Fertilizer Unit

LET STURTEVANT ENGINEERING AND EQUIPMENT MAKE THIS YOUR GRANULAR FERTILIZER UNIT

If you operate a mixing plant, there's a granulator in your future. The signs are unmistakable. Granular fertilizer is replacing its powdered cousin faster than modern processors can keep up with the demand.

Take the case of Canada Packers, Limited, of St. John, New Brunswick. Fourteen months after Sturtevant engineers assisted in adapting this customer's plant to a granular product, the balance of orders had shifted to 70% granular against 30% powder — *and management expects in a very short time (perhaps as you read this) that shipments will be 100% granular.*

Of course, we at Sturtevant Mill Co. are not market authorities, although we do believe this experience by Canada Packers, Limited is significant.

Our business is to assist you with the designing and engineering of the best possible granular fertilizer unit for your needs — also super phosphate units and conventional mixing units, according to your requirements.

Serving the fertilizer industry has been our business since 1873 . . . which is why you won't get rash promises or rush engineering when you come to Sturtevant. You will get a unit that will produce *what* it's supposed to *when* it's supposed to.

Why not let Sturtevant help you to spell out *your* future in granular fertilizers by writing today? Use the convenient coupon on the right.

STURTEVANT

Dry Processing Equipment

The "OPEN DOOR" to lower operating costs over more years

PULVERIZERS • CRUSHERS • MICRON-GRINDERS • GRANULATORS • SEPARATORS
SCREENS • MIXERS • FEEDERS • ELEVATORS • CONVEYORS
MECHANICAL DEN & EXCAVATORS

STURTEVANT MILL COMPANY, 123 Clayton Street, Boston 22, Mass.

Please send me your bulletin on Granulators ☐
Also bulletins on Sturtevant machines for:

☐ CRUSHING ☐ GRINDING ☐ PULVERIZING
☐ MICRON-GRINDING ☐ SEPARATING ☐ MIXING
☐ SCREENING ☐ FEEDING
☐ MECHANICAL DEN & EXCAVATORS ☐ ELEVATING & CONVEYING

I am interested in a new unit ☐ conversion ☐
Desired capacity is________
Name________ Title________
Firm________
Street________
City________ Zone____ State________

NOW ON STREAM!

Escambia Bay Chemical Corporation, Pensacola, Florida — the only plant of its type on the Gulf Coast, east of New Orleans!

NOW PRODUCING A CONTINUOUS SUPPLY OF ANHYDROUS AMMONIA, NITRIC ACID, BAY-SOL NITROGEN SOLUTIONS, AND—

AMMO-NITE

AMMONIUM NITRATE FERTILIZER

Containing 33.5% Nitrogen

Sell AMMO-NITE . . . and you can offer your customers *more* Nitrogen for *less* money than other plant food forms. Simple arithmetic proves it! More Nitrogen in every bag means less bulk and weight for you and your customers. Uniform AMMO-NITE prills flow freely, spread evenly — never clog or stick in the spreader. AMMO-NITE leaches far less, too! New *stay-dry* bags keep AMMO-NITE in perfect condition in any weather. Order now. *It's a money-maker!*

GROW IT RIGHT WITH
AMMO-NITE!

Products of the Escambia Bay Chemical Corporation, Pensacola, Florida, are distributed exclusively by

ASHCRAFT-WILKINSON COMPANY, Atlanta, Georgia

Manufactured by
CHEMAGRO
CORPORATION
New York, N. Y.

Under license from
FARBENFABRIKEN
BAYER
Leverkusen, Germany

DIPTEREX*

Sugar Bait Fly Killer

DIPTEREX attracts and kills both resistant and non-resistant strains of houseflies with outstanding effectiveness. It is approved for use inside and around dairy barns, poultry houses, stables, stock pens and similar areas where fly populations are intense or bothersome.

The active ingredient of DIPTEREX Sugar Bait Fly Killer is Bayer L 13/59, a recent chemical development of Farbenfabriken Bayer.

DIPTEREX will be available to distributors for the 1956 season in ten pound metal pails packed four to a case and in one pound canisters packed twelve to a case.

* Registered Trademark

CHEMAGRO CORPORATION
101 PARK AVENUE, NEW YORK 17, N.Y.

The new Bemis Fertilizer Packer gives you a money-saving combination of speed and accuracy never available before

Smith-Douglass Selects New Packer

This photograph shows the New Bemis Fertilizer Packers in operation in the big Smith-Douglass plant in Streator, Illinois. Smith-Douglass' Plant Superintendent says, "After a thorough test, we find that the Bemis Fertilizer Packer is setting a new record for accuracy. We like it and our men like it."

The fertilizer you save through accurate weights and the labor you save through speed and a smaller crew will soon pay for your new Bemis Fertilizer Packer.

In actual plant operation the Bemis Packer is filling and closing sixteen to eighteen 80-lb. bags per minute . . . and holding to a weight tolerance of plus or minus 4-oz.

A major reason for this exceptional performance is the Bemis-originated 3-bucket design, which gives more time to fill each scale accurately.

Other features . . .

- ☆ The Bemis-designed automatic sewing machine actuator and cutoff.
- ☆ The Vee-Trof conveyor, which holds the bags upright without rails...no wrestling with filled bags. Your plant employees will think it's wonderful.
- ☆ A choice of automatic or manual discharge.
- ☆ A maximum of two men per unit is needed to operate.
- ☆ Size range—50, 80, 100 lb. multiwall bags; 100, 200 lb. textile bags.

This is the biggest advance in fertilizer packing in many years.

Get the complete story from your Bemis Man promptly.

P. S.—JETROL—a New, Better Way to Add Insecticide to Fertilizer.

Bemis engineers have just perfected and successfully tested JETROL—an attachment for the new Bemis Fertilizer Packer which adds liquid insecticide, in a fixed quantity by volume and by weight, to fertilizer as it is being bagged. JETROL is accurate, consistent, and minimizes toxic problems. The cost? You'll be agreeably surprised.

Bemis

BEMIS
BRO. BAG CO

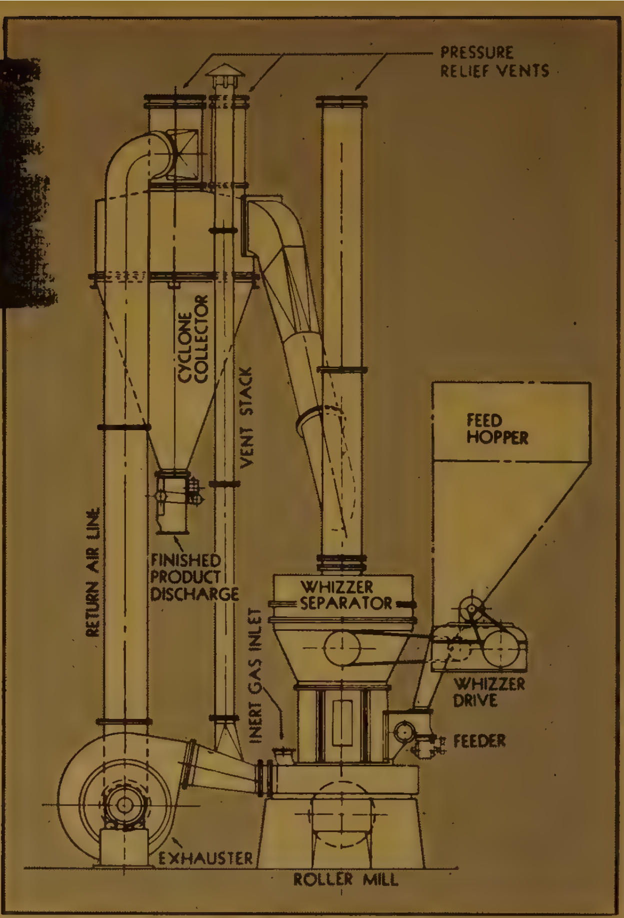
General Offices—St. Louis 2, Mo.
Sales Offices in Principal Cities

Bemis Bags for the Fertilizer Industry

Multiwall • Burlap • Cotton
Waterproof (laminated-textile)

SULPHUR GRINDING

A STANDARD OPERATION with the RAYMOND ROLLER MILL



THE diagram shows how this modern design Roller Mill is equipped to provide clean, safe, dustless operation in making fine grades of sulphur and blended mixtures of sulphur-bearing insecticides.

The entire mill system is blanketed with inert CO_2 gas, and special ball bearings designed for sulphur grinding are used throughout.

Electric-welded heavy-gauge piping with pressure relief vents at top, and double discharge valve at bottom of the cyclone collector, insure gas-tight method of processing.

The slow speed of the Mill, and the extra large air passages through the Whizzer Separator, prevent the sulphur from overheating and sticking.

Raymond Roller Mills with their ease of control, economy of production and uniformity of finished material, are equally efficient for handling the various modern insecticide formulations as well as phosphate rock fertilizer.

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- **Potatoes** (Scab and Damping-Off)
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UNDER TEST:

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Also diseases of Celery, Garlic, Peanuts, Peppers and Tomatoes.

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Available as: 20% Dust, 75% Wettable Powder and 2 Lb. Emulsifiable.

*TERRACLOR is a trademark of Olin Mathieson Chemical Corporation

CHEMICAL
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It takes *time* and *big* capacity to produce the finest Triple Superphosphate. And International's Bonnie Plant was designed with both in mind. No compromise in quality — every batch is *natural* cured to give you a guaranteed minimum of 46% A.P.A. No compromise in supply and delivery — the mammoth natural curing unit, as big as *two* full-sized football fields, has a 85,000-ton capacity to meet peak demands.

Result: you can depend on International for *natural-cured* Triple Super that gives you finer, more uniform particles . . . and more complete ammoniation. It's one more way to help you reduce costs of your finished product. If you're not already using this finer Triple Super, write or wire for samples and quotations.

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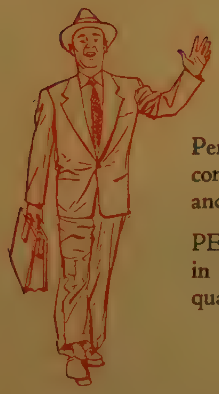

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Formulators are in sharp disagreement with the opinions of this anti-social aphid.

Tackles Troublemakers. Attaclay is the carrier and diluent that helps you lick stickiness . . . heaviness . . . lumpiness—three troublemakers for the producers (and users) of dust bases, wettable powders, and finished dusts.

Primary Processors like the great fluidity of Attaclay, as received. Its super-sorptivity eases grinding steps—makes it a "natural" for liquid impregnation—keeps dusts on the move through materials handling equipment—delivers dry, free-flowing premium-grade products.

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· APPLICATION INTERVAL ·
UP TO 72 HOURS BEFORE HARVEST

MALATHION MAY BE USED ON FORTY RAW AGRICULTURAL COMMODITIES! The order establishing a tolerance of *8 parts per million* for malathion residues in or on *forty raw agricultural commodities* was published in the Federal Register on October 20, 1955.

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CROPS WITH A 72-HOUR INTERVAL BETWEEN LAST APPLICATION AND HARVEST:

- Apple
- Cherry
- Pear
- Plums
- Prunes
- Blueberry
- Cranberry
- Strawberry
- Grapes
- Beans
- Broccoli
- Rutabaga
- Cucumber
- Squash
- Melon
- Tomato
- Eggplant
- Onion
- Peas
- Peppers
- Potato

CROPS WITH A 7-DAY INTERVAL BETWEEN LAST APPLICATION AND HARVEST:

- Apricot
- Avocado
- Dates
- Peaches
- Pineapple
- Alfalfa
- Beets
- Celery
- Cauliflower
- Cabbage
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NO two jobs are exactly alike—that's why Union Special builds a wide variety of bag closing equipment. In the Union Special line you will find machines for closing all sizes and kinds of bags from small textile or paper bags of one pound, or less, up to the largest multiwall paper bags in use today. Whether your production schedule calls for closing just a few bags or for high continuous output, Union Special can supply the equipment to do the work efficiently, economically, dependably!

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Union Special representatives located in all leading industrial centers are qualified by experience and training to give you expert recommendations. Take advantage of the service they offer.

Ask for recommendations. UNION SPECIAL MACHINE CO., 447 North Franklin St., Chicago 10, Illinois.

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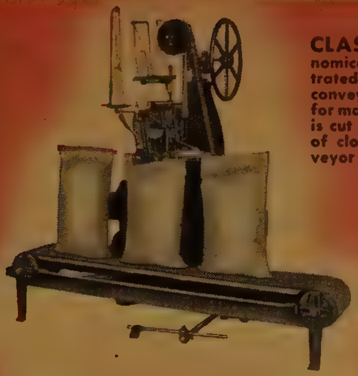
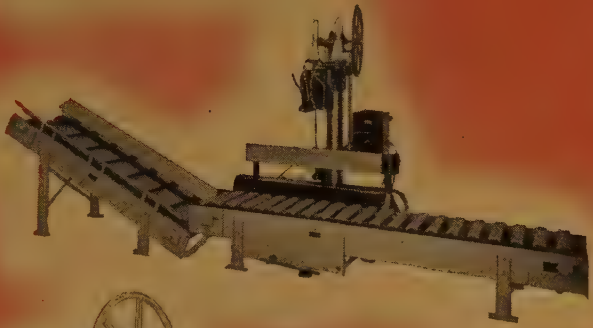
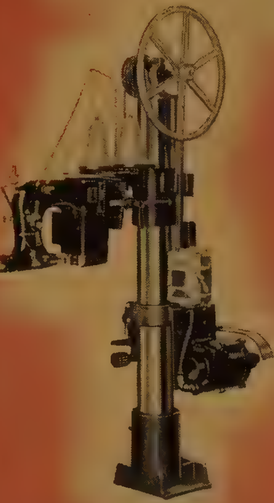


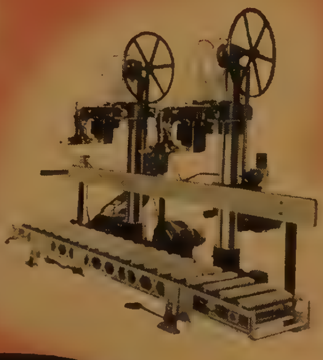
CLASS 21800 *(left)* for fast, economical closing of paper bags. Illustrated is Style 21800 H with 5 ft. conveyor and 80600 H sewing head for making tape bound closure. Tape is cut off automatically at each end of closure. Sewing head and conveyor adjustable vertically.



CLASS 20500 *(above)* machines are heavy duty, high production units for closing medium and heavy weight bags. Available with power-driven horizontal conveyor, inclined conveyor, or both; or with conveyor transmission unit only, for plant production line.



STYLE 20100 H *(left)*, is a heavy duty, high production column type machine designed for use with plant conveyor systems. Sewing head is pedal controlled.



DUPLEX MACHINES *(right)* are designed for closing double bags. The first sewing head closes the inner bag; the second closes either the outer bag alone, or both bags together for extra safety. Also recommended for single closures where continuous operation is a must—operator can instantly switch to other head.

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Monsanto will help you sell your brand

Starting this spring Monsanto is sponsoring the first nationwide promotion to sell farmers on the advantages of liquid mixed fertilizers, and on the help and service farmers can get from you, and how Monsanto's phosphatic fertilizer solution improves liquid fertilizer performance.

Tops for phosphorus: Monsanto's phosphatic fertilizer solution

Monsanto's phosphatic fertilizer solution is made by the electric furnace process and is of such quality that it eliminates equipment clogging. It lets you make complete liquid fertilizers at competitive prices.

Expand the liquid fertilizer market with Monsanto

For formulators operating within a limited market area there's extra advertising value in joining with nationally known Monsanto in this liquid fertilizer promotion. To help you get full benefit Monsanto supplies free the merchandising and advertising aids described in the box at right.

Profits are waiting—send for details today

For easier, better formulating—for improved fertilizer solutions—for more sales and bigger profits: share in this big promotion. Write today for leaflet "Details of Liquid Fertilizer Promotion": MONSANTO CHEMICAL COMPANY, Inorganic Chemicals Division, Dept. A. C., 710 North Twelfth Blvd., St. Louis 1, Missouri.

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- Big farm paper ad campaign by Monsanto (to help you sell)

Write for *"Details of Liquid Fertilizer Promotion,"* which gives you all the information.

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TRONA® POTASH *for Agriculture*

In 1917 state fairs were awarding prizes for outstanding farm products just as they are today. Then as now, growers depended on Trona® MURIATE OF POTASH for high quality crops. For it was in 1917 that Trona, first to produce domestic Potash when World War I pinched-off foreign sources, shipped the first trainload to the east coast. For the next twenty years Trona was the *only* domestic source of Potash and today, in spite of AMERICAN POTASH AND CHEMICAL CORPORATION'S broad diversification program, is still one of the primary basic suppliers of high grade Muriate and Sulphate of Potash for Agriculture.

MURIATE of POTASH, agricultural grades 95-98% KCL, (60% K_2O minimum), regular and granular.

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a revolutionary new systemic insecticide
THIMET®

. . . controls early-season cotton insects without sprays or dusts!

Thimet *applied to the cotton seed stays with the plant in the critical early weeks of growth.*

Some questions and answers about Thimet *insecticide:*

Q. *How does it work?*

A. Thimet is applied to the cotton seed before the seed is planted. As the plant grows, Thimet is taken up from the treated seed and stays with the plant during early weeks of growth. The plant protects itself against insect damage!

Q. *What are the advantages of using* Thimet*-treated seed?*

A. Thimet gives "built-in" protection against pests which stunt, deform and retard the growth of young cotton. It eliminates the cost, time and labor involved in applying the 2 to 4 sprays or dusts ordinarily necessary to control these pests. And it also eliminates the worry of *when* to spray or dust. Thimet protects the *whole* plant as it grows.

Q. *What insects does* Thimet *control and for how long?*

A. Thimet controls thrips, aphids and spider mites for the first 4 to 7 weeks of the growing season. These are the insects most damaging to young plants.

Q. *Has* Thimet *been thoroughly tested?*

A. Under experimental code number 3911, Thimet was tested widely in 1955 by U.S. Department of Agriculture and state researchers across the cotton belt. "Proved highly effective in controlling early-season pests," reports USDA.

HERE IS STILL ANOTHER exciting new development of American Cyanamid agricultural research, which has brought you malathion and parathion, and many other important agricultural chemicals. Thimet has been accepted by the USDA and will be used this year in certain cotton areas. Extensive field testing now in progress may result in the acceptance of Thimet for use on other crops, too. For further information, write to . . .

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- THIMET® Insecticide
- CYANOGAS® Calcium Cyanide Fumigants
- HCN Fumigants
- POTASSIUM CYANATE Weedkiller for Agriculture and Turf

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Editorial
COMMENTS

AN interesting experiment was conducted last season in Lower Merion Township, near Philadelphia, in the aerial spraying of a woodland area. Since the area included a high percentage of suburban residential sites, recreational spots, etc., it was with some reluctance that the authorities in charge resorted to aerial spraying, for they had necessarily to anticipate opposition from many sources, including bird and wildlife lovers. The project, to be described in the May issue of *Agricultural Chemicals,* was an unqualified success. Ninety percent control was achieved, and no serious problems were encountered.

Success of this experiment may well open the door to similar spray programs in other areas. Indeed just such a program, along much more extensive and elaborate lines, is reported to be about ready to get under way in the forested urban areas of northern New Jersey, Westchester County, New York, and nearby Connecticut. More on this big new project, too, in our May issue.

INSECTICIDE business will be good this year. This view is being voiced almost universally in the trade as the 1956 season gets under way. The reasons for this optimism are readily apparent. New markets which have opened up over the past few seasons figure to be even bigger this year. Fertilizer-pesticide mixtures made spectacular gains in '55, and figure to do even better in '56. The market for soil fumigants is still expanding at a rapid rate. Nematocides are opening up new and profitable markets.

Another important factor is that the heavy excess stocks of pesticides which hung over the market for the past few seasons have finally been liquidated. The export market has taken a tremendous volume of what could have been carryover material, and government buying has sopped up big quantities of insecticide staples like DDT and BHC. Indeed some producers are themselves in the market for added stocks to build up inventories to a safe margin as the season opens.

It could be one of those years like '51 again,—with buyers clamoring by mid-season for melting supplies of essential pesticides. And if manufacturers and formulators alike will for once forget volume just for the sake of volume, and insist on making each transaction yield a profit, the black figures could be very appealing by September.

WHO is going to discover, test and market our insecticides of the future? Who, in all sincerity, is going to have the available risk capital, — and the optimism — to get this important job done? The tremendous costs involved in developing, testing and marketing a successful new pesticide were outlined once more last month by a speaker at the Hollywood meeting of NACA. (See pg. 30-34). This speaker put today's cost of developing a new malathion, toxaphene or dieldrin at $1,200,000 and cautioned that "no company can remain long in the field if it cannot so plan and execute its merchandising that it will not only recapture its re-

(*Continued on Page* 127)

Top Left: George Decker, Illinois State Nat. History Survey, George P. Larrick, Commissioner of Food and Drugs, and H. L. Haller, USDA.

Top Right: Jack Miller, Atlas Powder Co., T. W. Brasfield, Naugatuck Chemical, D. C. Van Winkle, Atlas, and Mercer Rowe, Ashcraft-Wilkinson Co.

Bottom Left: R. W. Wert, Minerals & Chemicals Corp., Lea S. Hitchner, NAC, Ralph Dorland, **Agricultural Chemicals**, and J. W. Dolson, Hercules Powder Co.

Bottom Right: Paul Torpin, MGK, J. M. Taylor, Taylor Chemical Co., C. M. Brown, General Chem. Div., Allied, and E. H. Phillips, GLF.

Facing Page, top: Paul Mayfield, Hercules Powder Co., and A. W. Mohr, California Spray-Chemical Corp.

Facing Page, bottom: Fred Hatch, Shell Chemical Corp., vice-president of NAC, and William Allen, Dow Chemical Co., NAC president.

THE problems of the cotton grower are of vital concern to the agricultural chemicals industry, NAC members were told at their spring meeting March 14-16 by Dr. H. G. Johnston, of the National Cotton Council, who further pointed out that if cotton loses its competitive battle, the agricultural chemicals industry will lose its biggest customer. Dr. Johnston urged the National Agricultural Chemicals Association to support and encourage a "stepped-up-research program" aimed at lowering production costs and keeping cotton competitive. The address was one of several presented at the NAC meeting held at the Hollywood Beach Hotel, Hollywood, Fla.

In further outlining the cotton problem, Dr. Johnston explained how rayon had out-researched cotton in the tire cord market, seizing 600,000 bales. The loss of such a market, he said, also represents a loss in customers for agricultural chemicals, as cotton, rather than being replaced by another agricultural commodity, loses out to man-made fibers. To meet its competition, observed Dr. Johnston, cotton must today put up a desperate fight on three fronts . . . the price at which it can be purchased, the quality of its fiber, and effectiveness of its sales promotion.

There is only one way for cotton to reduce its price and hold on to its customers, and that, he said, is by reducing the cost of production. "Our chief hope for continually pushing our cost downward . . . is built on the idea of maintaining or speeding up our rate of technological progress. Great as has been this progress, cotton is in desperate need for basic research." "The lack of basic research is beginning to hem use in on all sides, as we seek important advances in production efficiency. It is, in addition, sharply holding back the wider and more intensive use of agricultural chemicals."

Dr. Johnston appealed to the NAC for support in research to improve quality and reduce costs. "Cotton's destiny," he said, "rests inevitably on its ability to build adequate programs of research and education." "Cotton needs the kind of basic research which delves into the inner processes of the plant to find out, for example, how the plant itself can be

Research on Safety—theme at NAC Convention in Florida

more efficient — put on more bolls and less vegetation," . . . what we need too, he pointed out, are herbicides that are selective in action; herbicides which will definitely kill weeds but not cotton. But even more important, he emphasized, the cotton industry needs to know what goes on *inside* the plant, so that more effective use can be made of chemicals already available.

Costs of Basic Research

THE phenomenal growth of agricultural chemicals industry was pointed out by J. A. Field in presenting a report on agricultural chemicals marketing prepared by himself and R. H. Wellman, both of Carbide & Carbon Chemical Co., New York. Mr. Field observed that since 1939 the industry has grown from $40 million to $200 million of sales, and from 50 basic products to more than 200. Between 80 and 90% of today's sales, he said, are in products which were not even on the market 12 years ago. At the present rate of growth (8% a year), agricultural chemicals sales should reach $1 billion a year by 1975.

Against this background, Mr. Field discussed the many problems and costs involved in developing a new successful agricultural chemical. To develop one successful product, about 1,800 compounds must be synthesized and run through biological screens; and for the investigations and research to be completed the full price tag is about $1,200,000. "At this cost, he said, "no company with a fully co-ordinated agricultural chemicals program can remain long in the field if it cannot so plan and execute its merchandising that it will not only recapture its research investment but also obtain the rewards in profits that its risk and enterprise justify."

"Bear in mind that the cost of research applies only to the actual testing of compounds for activity in well-defined areas of application. In addition," he continued, "the expenditure of funds and efforts is needed in other fields of "blue sky" research. The mechanism of action of chemicals, their effect on growth, flowering, fruit yield, and many other questions of a like nature await an answer.

Such information will enable us to supply the farmer with even more potent, specific, and safer pesticides—and other new improved aids in the future. Work of this nature is expensive, time consuming, and likely to bear fruit only many years after its initiation. Unless agricultural chemicals are a profitable business, there is no incentive for a company to embark on such a program."

The factors to be considered in the development of an agricultural chemical were listed as: market study, timing, physical and chemical properties, formulation, biological activity, product specifications, toxicological data and residues, labeling, patent considerations, advertising and publicity. Mr. Field discussed each factor, commenting on related problems and considerations. In connection with labeling, he stressed the fact that "all the claims we make about our agricultural chemicals must be very carefully handled. First, they must be the truth, then they must be *all the pertinent truth,* and finally they must be the truth in language the farmer understands. One of our most serious responsibilities," he emphasized," is to have our labeling so worded that a farmer following our directions will not end the season with a crop having a residue in excess of that allowed."

Future of Fungicides

IT is physically impossible to determine exactly how much damage plant diseases are doing in spite of an expenditure of about 125 million dollars a year in their control, reported Dr. George L. McNew, director of Boyce Thompson Institute for Plant Research, Yonkers, New York, in a discussion of the "Future of Fungicides in Agriculture." The best estimate, he said, for the decade 1942-1951 was a loss of 2.8 billion dollars on the farm or seven per cent of all crop and forest productivity. When the losses in transit and storage are added to this figure, the annual loss in the U. S. may be conservatively placed at about $24.20 per person.

The primary producer, reported Dr. McNew, can look forward to a sales volume of about 85 million dollars to satisfy the potential needs of our agricultural economy for fungicidal chemicals. Such a market justifies an expenditure of about 3 million dollars for research on agricultural fungicides. In what markets should this investment be placed? In other words, he asked, where is the major need for research?

Answering this question, Dr. McNew reported that four of the several

(1) J. J. Lawler, Fred Hatch and S. J. Hastings, all of Shell.

(2) E. A. Georgi, United Cooperatives, Tom Collins, General Chemical, Robt. Peacock, General Reduction Co., Clark Bellamy, Acme Fertilizer Co., and Al Connelly, General.

(3) Wm. Haude, Grace Chemical Co., M. E. Clark, Frontier Chemical Co., and F. H. Cappy, American Cyanamid Co.

(4) W. A. Haines, Hercules, Wm. Self, Riverside Chem. Co., C. P. Zorsch, Monsanto Chemical Co., and (center) Russell Coleman, Natl. Plant Food Institute.

(5) Ted Riedeburg, Theodore Riedeburg Associates, E. W. Segebrecht, Spencer Chemical Co., and Ira Vandewater, Montrose Chemical Co.

(6) Glenn Gulikson, Dow Chemical Co., Chas. Whinfrey, Penn Salt, Ken Krausche, Floridin Co., Al Raufer, Michigan Chemical Corp., and Jack Moore, Floridin Co.

(7) Tom Snipes, Chemagro, H. W. Swink, Pittsburgh Coke, and Ken Holden, Chemagro.

(8) A. Petrus, Cotton States Chem. Co., Jack Vernon, Niagara Chem. Div., Carl Behse, Agricultural Chemicals, Inc., and Fred Hogg, Hercules Powder.

(9) E. L. Thomas and J. W. Whittaker of Swift & Co., Dr. W. E. Dove, Fairfield Chemical, and (seated) R. Lemmon, of Mackwin, and Carlos Kampmeier, Rohm & Haas.

(10) Mrs. Weed, G. F. Leonard, and Dr. Alfred Weed, Olin Mathieson Chem. Corp.

(11) Jack Polite, Diamond, C. O. Barnard, Western Agr. Chemicals Assn., and John Stoddard, Prentiss Drug & Chem. Co.

(12) W. K. Feustel, R. T. Vanderbilt Co., Wayne Yoder, American Cyanamid, Bill Gehweiler, Vanderbilt, Art Bixby and Nick Walker, Pennsalt.

outstanding markets that should be developed are: (1) soil fungicides and nematocides to control root rots, wilts, and seed decays; (2) bactericidal chemicals to control leaf blights, stem cankers,and wilts; (3) rust and powder mildew eradicants that can be used at low dosages per acre by aerial application; and (4) systemic protectants that can be used to eliminate established infections of wilts, cankers, and foliage where parasites are inaccessible to surface deposits.

The future needs of agriculture and industry in suppressing microbiological deterioration will be met only if research is put on a sound basis, observed Dr. McNew. It calls for patient money . . . extremely patient funds; but it also calls for realism. Management of industry and government cannot be expected to invest money in this cause no matter how worthy and demanding unless the scientist can provide the ideas and demonstrate that he has the tools and skill to implement them. The scientists interested in this problem must look at the problems of management before they look at the research ideas.

Dr. McNew confirmed Mr. Field's comments on the odds of finding successful commercial insecticides. He indicated, however, that fungicides are relatively easy to discover. In random testing, they are discovered 5 to 10 times more frequently than insecticides. "Still," he said, "good, new fungicides rarely attain a large volume of sales in less than five years after discovery. The period for Ferbam was seven years, Thiram, nine, Spergon three and Nabam about four years from announcement to commercialization. This long period comes from the fact that each material must be tested under a variety of field conditions, and tests are seasonal in nature. The chances of materials promising in the greenhouse serving effectively at competitive dosages when they go to the field are no better than 1 to 15."

Dr. McNew observed that although laboratory methods have been perfected to precise routines in the evaluation of fungicides, no one has studied why materials which often appear promising in the laboratory fail in the fields . . . Emphasizing the recognition of more 'basic research' in agricultural chemicals, Dr. McNew announced that Boyce Thompson is investing $200,000 to further improve and implement its research facilities.

Atomic Energy Applications

IN a report on "Atomic Energy in Agriculture," Sterling B. Hendricks, USDA, Beltsville, Md., defined "atomic energy" as (1) energy, (2) radioactivity, and (3) radioactive isotopes. "It is in these terms that we have to discuss applications in agriculture," he said.

The place where most energy enters into agricultural work at this time at a point of concentration is in the production of nitrogenous compounds; the second potential interest of agriculture in atomic matters is in radioactivity or better penetration radiation . . . more specifically, radiations may be considered as a means of sterilizing agricultural products or things of interest to agriculture, e.g. using radiation to increase storage life of meat or vegetables and of killing insect infestations. Still, Mr. Hendricks pointed out that the dosages are very high, and small units of materials have to be treated. Thus it would seem that the immediate promise is in a specialty use such as the preservation of meats in conjunction with refrigeration or under drastic conditions of storage such as for long periods in the tropics as required by the army.

Mr. Hendericks discussed the more familiar uses of radioactive energy as tracer elements; finding the distribution of dusts and sprays; together with suggestions of future uses of this form energy. He pointed out too that hazards to the workers arise as much from the insecticide or spray material as from any radioactivity used, "and these hazards," he said, "as you know are low."

The Research Scientist

WHILE several of the speakers at the NAC meeting emphasized the need and cost of research, the question of filling the need for technically trained personnel to carry on the various jobs outlined was left to J. Wayne Reitz, president of the University of Florida, who reviewed the obligations of universities in helping solve industry's personnel problems.

The problem of supplying the needs of the chemical industry and other industries for more and better trained personnel is a mutual problem of employers and the universities that can be solved only through the continuing cooperation of both parties, advised Mr. Reitz. He paid tribute to the agricultural segment of the chemicals industry for its enthusiastic support of the universities through grants, fellowships, and assistance in obtaining legislative appropriations.

Pointing out that the demand for technically trained men and women today is so great that there are virtually two jobs waiting for every university graduate, President Reitz stressed several aspects of the problem. One aspect he said concerns the kind of courses required of students in the professional fields. "We hear that our students are required to take too many courses on subjects not related to the professional field of interest. What does an entomologist care about the thoughts of Plato or the works of Shakespeare?

"We believe confidently that when our commercial organizations employ an entomologist or a chemist, they want something more than just an entomologist or a chemist. Of course they expect technical competence, but they also want people who have the background to adjust themselves to changing situations, to get along well with other people, and to be able to express themselves effectively. Also they want young people who give promise of handling additional and broader responsibilities as their careers develop."

President Reitz outlined the educational program at Florida and expressed a strong interest in working with industry in meeting its increasing requirements.

USDA Pesticide Program

DISCUSSING some of the work the USDA is doing with chemicals to control insects, plant diseases,

(1) M. Muskin; R. Cooney, Flag Sulphur & Chemical Co.; C. Griffith, R. W. Greef & Co.; J. Hewitt, Lebanon Chemical Co.; Harry Johnson, Triangle Chemical Co.

(2) J. Rodda, Fairfield Chemical Div., FMC; J. B. Maddrey, Planters Chemical Corp.; R. A. Lamoree, Stauffer Chemical Co.; and George Simches, Planters Chemical Corp.

(3) J. E. Bussart, Velsicol Chemical Co.; V. Rebak, Grace Chemical Co.; George Ahl, Summit Mining Corp.; and H. Grady, California Chemical Co.

(4) G. F. Kerbey, Fairfield Chemical Division, FMC; J. Kirk, Velsicol Chemical Corp.; J. Kennedy, Stauffer Chemical Co.; and R. H. F. Dade, Fairfield Chemical Division, FMC.

(5) E. R. Marsheall, GLF Soil Building Service; S. LeVasseur, M. Bunnell and L. Gemmell, all of Geigy Chemical Corp.

weeds and nematodes, Dr. H. L. Haller, Washington, D. C., advised that activities on these pests fall into three categories, namely research, regulatory, and control programs. Many parts of all three programs, he said, are carried out in cooperation with the states. The regulatory and control programs concern themselves with preventing diseases and injurious insects of foreign origin from entering the United States; combating the spread from state to state of injurious introduced diseases and pests of national importance which already are in the country; and assisting in the control and eradication of emergency outbreaks of serious diseases and pests.

As a part of these programs, insect surveys are made throughout the country to determine the location of the pests, their numbers, and damaging effects. This information is also made available to federal, state, and industrial organizations that advise the growers and others on crop pests. When a survey indicates the presence of a serious threat, the secretary of agriculture is empowered by law to initiate a regulatory, control, or an eradication program. Today, Dr. Haller reported, we have programs of this type in operation against 18 major crop pests. In addition, we carry on a continuing economic insect survey.

In reviewing the USDA research programs on insecticides, fungicides herbicides, and nematocides, Dr. Haller indicated that "there are still numerous pests for which the farmer needs effective control. Among the most important are those destructive pests that infest our soils." Increased interest is also evident in the control of pests such as various species of nematodes and plant diseases.

"We also need new materials and techniques for the control of range and grassland insects," advised Dr. Haller. Granulated insecticides need more study, and new materials are needed to control spider mites, which have become more serious with increased use of the newer insecticides.

In connection with research on new fungicides and antibiotics, he observed that "the problem is no longer concerned with developing an 'all-purpose' product, but instead emphasis is placed on the finding of compounds for specific fungi."

Dr. Haller concluded his review of research at the USDA with the remark that there will be no let-up in the pressure from farmers for new information on the control of crop pests. Instead, he said, it will increase. "We are all set to move ahead in our job of serving the farmers of the Nation."

Speaking also at the NAC meeting was George P. Larrick, U. S. Commissioner of Food and Drugs, who told members and guests that "To teach growers to use pesticides safely as well as effectively is in many respects our biggest job. It is by all odds the best way to protect the public in this field. We have a good law," he said, "but we also share this problem, which no law can solve, and which must be solved by education. It is my hope that NACA can expand its activities in this area, and that the Food and Drug Administration and other agencies in government can cooperate to the full extent that is needed to do this educational job. Like other types of safety education, this needs to be set up as a permanent and continuous activity."

"The Miller Amendment to the Food, Drug and Cosmetic Act requires the pretesting of pesticide chemicals for safety and for establish-

(Continued on Page 127)

Granulation of Mixed Fertilizers

*by John O. Hardesty**

Fertilizer and Agricultural Lime Section
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Beltsville, Maryland

IN attempting to incorporate the most desirable qualities in a granular mixed fertilizer, the manufacturer of the product is faced with the problem of bridging a wide gap between theory and practice. Theory, in this instance, is defined as an analysis of a given set of factors in their ideal relationships to one another. The ideal may often be at variance with practice, which is actual performance of the process or the product. However, practice is seldom improved without aiming, at least, in the direction of the ideal. For the purpose of discussion in this article, the following specifications are the author's conception of the *ideal* properties for a granular mixed fertilizer:

1. *Particle size;* 10-14 Tyler Standard mesh (screen openings 1.651-1.168 mm.)
2. *Particle shape;* spherical.
3. *Particle structure;* 95% of the particles to remain intact under a load equivalent to 100 lb./sq. in.
4. *Homogeneity;* each granule up-to-grade.
5. *Drillability;* product to be free of lumps and to maintain its original drilling rate for 1 hour when exposed to 88% relative humidity at 76° Fahrenheit.
6. *Fertilizing efficiency;* optimum delivery of nutrients to the growing plant.

Some of these specifications are beyond the realm of practical attainment, but none of them are beyond practical approach. For this reason, it seems desirable to give them more critical consideration.

Particle size

At present, there is no generally accepted definition of the particle-size limits between which a fixed proportion of a fertilizer should fall, for the product to be classed as granular. Manufacturing convenience and the attainment of improved physical condition determine largely the particle size. Examination of 28 representative samples of typical, commercial granular mixed fertilizer *(8)* showed an average particle-size distribution as follows:

Mesh (Tyler)	%
+6	12
6—8	21
8—14	38
14—20	11
20—35	11
—35	7

It is evident that the indicated ideal particle size (10-14 mesh) is well within the particle-size range of the average granular product. The granule size of the proposed ideal product is large enough to provide insurance against setting and caking, and yet small enough to permit reasonably uniform distribution at low applications, so that each plant is provided with a proportionate share of applied nutrients. For example, since the volumes of spheres are proportional to the cubes of their diameters, one 5-mesh granule (screen opening 3.962

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*Presented at the Industry Fertilizer Round Table, October, 1955, Washington, D. C.

mm.) is equivalent to fourteen 10-mesh granules (opening 1.651 mm.); therefore, if 5-mesh granules (5,700 granules/lb.) are applied at the rate of 150 lbs./acre with grain in rows 7 inches apart, approximately 11 granules are applied per linear foot, while, with 10-mesh granules, 154 granules are applied per linear foot.

Manufacture of the ideal granular product, whereby small moistened particles of raw materials are assembled into larger compacted granules, requires that the raw materials be considerably finer than 14 mesh. This may pose a difficult problem with respect to some grinding of raw materials, but a uniform granular product can be obtained only when the size of the prepared granules is several times that of the largest particles in the ingredient materials (4).

Particle shape

It is unreasonable to expect that every particle in a granular mixed fertilizer will be spherical. However, a large proportion of granules in the average product may be spheroidal in character. As the degree of sphericity of the particle is increased, the tendency toward caking becomes less. By virtue of fewer contacts per unit mass of particles, the free-flowing quality of the product improves, and there is less particle surface to be covered when coating agents are used.

Granules produced by spraying or prilling processes, such as prilled ammonium nitrate, usually have a high degree of sphericity *(10)* but the prilling process is not applicable to most mixed fertilizers. In the production of granular mixed fertilizers, the sphericity of the granule is increased by such processing expedients as fine-grinding of initial materials and compaction into firm granules by rolling the incipient agglomerates in a rotating cylinder during their slow congelation. The latter procedure requires accurate control of moisture and temperature relationships during processing *(5)*. Another way of obtaining more uniform sphericity of particles is to recycle crushed oversize material to the initial stages of the process, rather than incorporate it directly in the product.

Particle structure

Previous investigations *(4)* have indicated that at least 95% of the particles in most granular mixed fertilizers will remain intact under a load of 100 lb./sq. in. and that this granule-strength is sufficient to withstand the stresses imposed on the product by normal handling and storage. In this respect, most present-day granular products appear to approach the ideal fairly closely.

Field experiments, comparing the movement of nutrients from granular and powdered fertilizers *(11)*, have shown no appreciable difference in the rate of solution of inorganic nitrogen from granulated or powdered forms of 5-20-5 and 5-10-5 mixtures, band-placed in contact with the soil and between strips of Monel metal cloth. Inorganic nitrogen compounds, potassium chloride, and water-soluble phosphorus compounds, especially ammonium phosphates, dissolve out of the fertilizer quite rapidly, regardless of particle size *(7, 9, 11)*. While the percentage of available phosphorus in the residual substance of the fertilizer band was remarkably high after the fertilizer had been in the soil for a year *(4)*, there was no consistent relation between the size of the particle and the undissolved portion of the available phosphorus in the residue. Many mixed fertilizers, especially those formulated with ordinary superphosphate, retain their granular appearance after long periods in the soil, or even in water, owing to their content of less soluble constituents, such as calcium sulfate. However, this retention of granular appearance is not a reliable criterion of solubility or of the nutrient availability of the water-soluble constituents of the fertilizer. The residual granule, in such instances, usually is largely depleted of the most soluble nutrient constituents originally present *(7, 11)*.

Homogeneity

To expect that every granule in a granulated mixed fertilizer will be of the same composition is no more reasonable than to expect that they will be of the same shape. And yet, in proportion to the degree that homogeneity in composition is approached, segregation during storage, handling, and drilling of the fertilizer is decreased, and variations in sampling are reduced, so that analytical results on different samples of the product become more uniform.

Analyses of 28 granulated commercial mixtures *(8)* have indicated that N tends to be more uniformly distributed among the different size fractions of the fertilizer than either P_2O_5, which accumulates in the coarse fractions, or K_2O which accumulates in the fines. The greatest deviations from grade occur in the highest analysis mixtures. In mixtures averaging 41% total nutrient content, the P_2O_5 averages 1.9 units above grade in the coarse fraction and 1.5 units below grade in the fine fraction. The K_2O averages 2.9 units above grade in the fine fraction and 0.5 unit below grade in the coarse fraction. By comparison, nitrogen tends to be slightly below grade in both the fine and coarse fractions and above grade in the medium fraction with a maximum difference of only 0.5 unit. The difficulty of obtaining a representative sample of such products is probably no greater than that for non-granular products, except possibly in the case of mixtures formulated with raw materials containing high proportions of particles as large as those of the final granulated product.

In these exceptional cases of undesirable particle size of initial materials, the only apparent aid to greater uniformity in granule composition of the product is finer grinding and adequate blending of initial materials. Returning to the relation between particle size and volume, it is interesting to note that eight 20-mesh particles, sixty-two 35-mesh particles, or five hundred 65-mesh particles are equivalent to one 10-mesh granule. The tendency of granules in the final product to be more uniform in chemical composition increases with a decrease in particle size of the initial materials *(4)*.

Granulation of mixed fertilizer from slurry improves the uniformity of composition of the product, though it does not nullify the need for fine-grinding of initial solid ingredients.

Much remains to be accomplished

with respect to improving grinding and blending equipment and physical and chemical specifications on raw materials used in mixed-fertilizer granulation plants, but there is every indication that materials producers and machinery manufacturers are giving serious attention to these problems. Research and industrial experience on these phases of the process should result in the production of granular mixtures with greater average uniformity in chemical composition.

Drillability

Many present-day, high-analysis, mixed fertilizers are formulated with high amounts of economical forms of nitrogen, for example, ammoniating solutions containing such hygroscopic materials as ammonium nitrate and urea. Granulation, drying, coating, and packaging in high-grade moisture-resistant bags makes possible the satisfactory use of many such products that otherwise could not be used because of poor physical condition. Segregation, caking, and moisture absorption during storage and transportation of the products are greatly reduced, and the drillability is thus improved. However, an additional factor to be considered in evaluating the ultimate drillability is the effect of moisture absorption during the drilling operation on distribution of the more hygroscopic products. This undesirable characteristic of the product, which may not be apparent at the outset of drilling operations, is as important to the consumer as those of segregation and caking, which are usually apparent when the bag is opened for distribution in the field.

Drillability testing equipment at Beltsville, Md. is designed in such a way as to make possible a comparison of the effect of moisture absorption on the drillability of different fertilizers during the drilling operation. This equipment was constructed in cooperation with the Agricultural Engineering Research Branch of the Department. It consists of a drillhopper mechanism mounted over a variable-speed, endless belt divided into six-inch sections for collecting the fertilizer at any desired rate of application. Comparative weights of fertilizer from different sections of the belt indicate the degree of uniformity obtained during the operation. The equipment is 20 feet in length and is housed in a constant temperature-humidity room.

Comparative drillability tests have been made on a number of experimental and commercial products, some of which are known to drill satisfactorily under rather severe field conditions. The results (unpublished data) indicate that a product which maintains its original uniform drilling rate for 1 hour at 88% relative humidity and 76° Fahrenheit will drill satisfactorily under severe field conditions insofar as the effect of moisture absorption on drillability is concerned. Many of the high-analysis mixtures tested, some of which contained as much as 785 pounds of ammonium nitrate per ton, met this requirement. A sample of grained ammonium nitrate, which ordinarily drills satisfactorily under normal atmospheric conditions in the field, did not meet requirements of this test.

Fertilizer Efficiency

While the ideal in fertilizer manufacture is to provide a product that will give optimum delivery of nutrients to the growing plant, the conditions for approaching such an ideal are dependent, not only on the physical and chemical characteristics of the fertilizer, but on variable requirement factors among different soils and crops. The fertilizer industry has had wide experience in formulating and processing fertilizers to meet such soil and plant requirements as have been well-defined by agronomic research and farm practice; *viz.* low-chlorine goods for tobacco, boron in mixtures for legumes, magnesium in some potato fertilizers, etc. Future developments might be devoted to the production of special mixtures with less soluble, slowly available forms of nitrogen and potassium for the purpose of avoiding germination and seedling injury and losses of these nutrients by leaching. Currently-marketed mixtures containing slowly available nitrogen from urea-formaldehyde reaction products are typical examples of such developments.

Considerable attention has been given in recent years to the forms and solubility of phosphates in mixed fertilizers. Analyses of 420 samples of mixed fertilizer marketed in various regions of the United States during the 1949-1950 fertilizer season *(1)* showed that the proportion of P_2O_5 soluble in water ranged from an average of 35.2% in the East South Central States to an average of 70.7 in the Mountain States. For the United States as a whole, the percentage of available P_2O_5 in water-soluble form in all mixtures ranged from 2.8 to 99.7%, with an average of 50.2%.

Water-soluble phosphates are usually more efficient sources of phosphorus for fast maturing, high-yielding crops grown on alkaline soils, such as predominate in the West, than are phosphates in which a major portion of the available P_2O_5 is insoluble in water. *(2, 3, 6, 12)*. The agronomic efficiency of water-soluble, as compared with water-insoluble, forms of phosphate is generally less affected by particle size of the fertilizer *(9, 12)*. Water-insoluble materials, such as dicalcium phosphate, are more effective in powdered form than in granular form when applied separately, but they become partially soluble and have greater agronomic efficiency in some granulated mixtures owing to their intimate contact with soluble salts in the granule *(13)*. There is growing evidence that, as the water-solubility of phosphorus falls below 40% of the total phosphorus content of the fertilizer, the value of the fertilizer becomes relatively less for fast maturing, high-yielding crops such as corn *(14)*. Granulated mixtures that meet the nutrient requirements of different soils and crops will be developed as the effects of fertilizer properties on agronomic efficiency become clearly defined.★★

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(*Continued on Page* 139)

Airplane view of Forsgate Farms, near Jamesburg, N. J. Included are a dairy herd, chicken hatchery, golf course and several farm crops.

FORSGATE FARMS

A diversified 1500-acre farm requiring varied fertilizers and pesticides

by H. Carson

A DAIRY HERD, a chicken hatchery, fields of alfalfa, wheat and corn, an ice cream plant and an 18-hole golf course—all on the same farm—make Forsgate Farms an interesting place to visit.

The farm, which was noted mainly for its show cattle and its big milk output until recent large sales of most of the herd, is located in the rolling northern New Jersey farm area, near Jamesburg.

Forsgate still has 80 head of fine dairy cattle, supplying milk to North Jersey homes, but that is a big drop from the nearly 700 head of Guernsey and Holstein cattle the farm boasted several years ago. Nowadays the emphasis is increasingly on the 10,000 Leghorn chickens at the big hatchery on the sprawling farm; a hatchery that produces a million chicks a season.

Agricultural Chemicals learned why Forsgate had decreased its dairy cattle and placed emphasis on chickens during a recent visit to the farm. AC also learned something of the farm practices at Forsgate—the fertilizers and pesticides being used in the various phases of the operation, and why.

When Forsgate had its big herd of dairy cattle, much of the time the stock was being displayed in dairy shows. With transportation and handling costs soaring, the farm managers found it unprofitable to continue showing their cattle.

Hence, the decision to reduce the herd and concentrate on a smaller group, exclusively for milk production. Today, three men feed, milk (automatically), and care for the cattle, whereas it formerly required 12-15 men with the larger herd.

Tied in with the dairy herd is the ice cream plant, used to convert part of the milk that is not needed for the home delivery routes.

Also on the farm is the 18-hole golf course, known as the Forsgate Country Club, which is becoming increasingly popular as a place for club meetings and parties, in addition to its attraction for golfers. The pasture lands, and fields of wheat, corn and alfalfa complete the layout.

Naturally, with such a diversified setup, Forsgate needs various agricultural chemicals to protect its animals and plants.

In the milk plant, for instance, manager Al Hunkele relies on 30 lb. cylinder aerosols, containing pyrethrum, for fly control, which is the paramount problem in such an operation. It takes 12 minutes for the entire milk plant with the bomb, manufactured by Virginia Smelting Co., Mr. Hunkele stated. Last summer it was particularly necessary to use an effective insecticide because the flies "were the worst they've been in 16 years," according to the milk plant manager.

Similarly, in the barns, Forsgate men use insecticides regularly to keep the cows free from annoying flies, as shown in the photo.

Chemicals Used on Farms

CHARLES BETTS, farm manager and an employee of Forsgate Farms for 26 years, took time out in the farm shop to tell AC about some of the chemicals used on the crops.

For the pea aphid and the spittlebug, attacking his alfalfa fields, Mr. Betts finds lindane quite effective. "I can't always get it on at the recommended time, because of weather, temperature and other factors," he admitted, "but when I do apply it, it gives wonderful results." He uses lindane almost exclusively, because it has been so effective. But a worse pest than the insects is chickweed, which, if left unchecked, can cause severe damage to alfalfa, particularly in new stands. Here Mr. Betts relies on Sinox PE, made by Standard Agricultural Chemicals, Inc., to do the job.

"When I use the stuff I make the men take safety precautions," he said, "including a muzzle to prevent inhalation of the dinitro weed killer."

This farm manager is no man to take short cuts where safety is concerned. He said he reads the labels carefully on all materials used for pest control on the 1500-acre farm.

He thinks it is important for the farm manager to assume responsibility for seeing that farm hands take every necessary precaution with pesticides, instead of concentrating on speed and ease of application. And by following the label directions carefully, he has found that most economical use can be made of the materials.

Mr. Betts doesn't claim to be the most scientific farmer in the world; rather he prefers to stick by the ways that have proved effective, even if the experts sometimes disagree. But he does rely on the recommendations of the state experiment station at Rutgers. When we visited him he was checking over "Pesticides for 1956," a booklet with recommendations from the College of Agriculture of the state university.

In determining fertilizer application, Mr. Betts falls back on his years of experience on the farm and his earlier experiences as a salesman with Chamberlin & Barclay, Inc., Cranbury, N.J., fertilizer company. He likes a fine, dry fertilizer that will spread evenly on corn and grain, although he has had good results with granulated ammonium nitrate for grain when it is above eight inchces high.

He is a firm believer in the value of soil tests in determining exact amounts of plant nutrients for his various fields. He sends samples of half a dozen plots each year to Seabrook Farms, near Bridgeton, for testing.

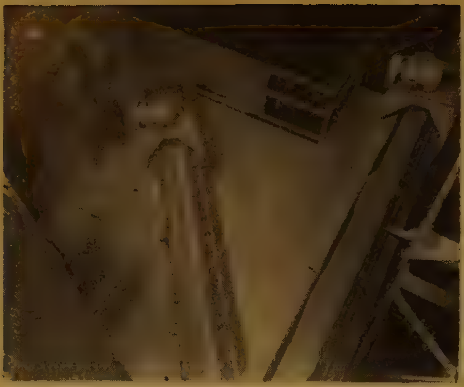
For corn he has found 5—10—5 a good grade, with 0—20—20 as a top dressing. His 84 acres of wheat get an application of 5—10—10 in the spring (no fall fertilization) and the 35 acres of pasture land 0—14—14, along with from 12 to 20 tons of cow manure an acre.

So far Mr. Betts hasn't yielded to the suggestions of fertilizer manufacturers that farmers buy early to assure themselves a good price and good supply. "I'd rather buy fertilizer when I need it and save myself handling and storage headaches."

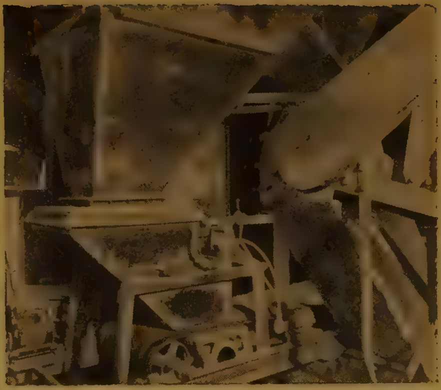
He buys fertilizer from Chamberlin — Barclay, Inc.; Bennett & Clayton Co., Virginia-Carolina Chemical Corp., Swift & Co., American Agricultural Chemical Co., and the G.L.F. Soil Builders, in nearby Englishtown.

Forsgate Farms was founded in 1917 by John A. Forster and commercialized to a big extent in 1931. John Forster O'Beall is the present owner, and Matthew Whelan the farm superintendent.★★

Cows are sprayed regularly in the Forsgate barns to control flies.

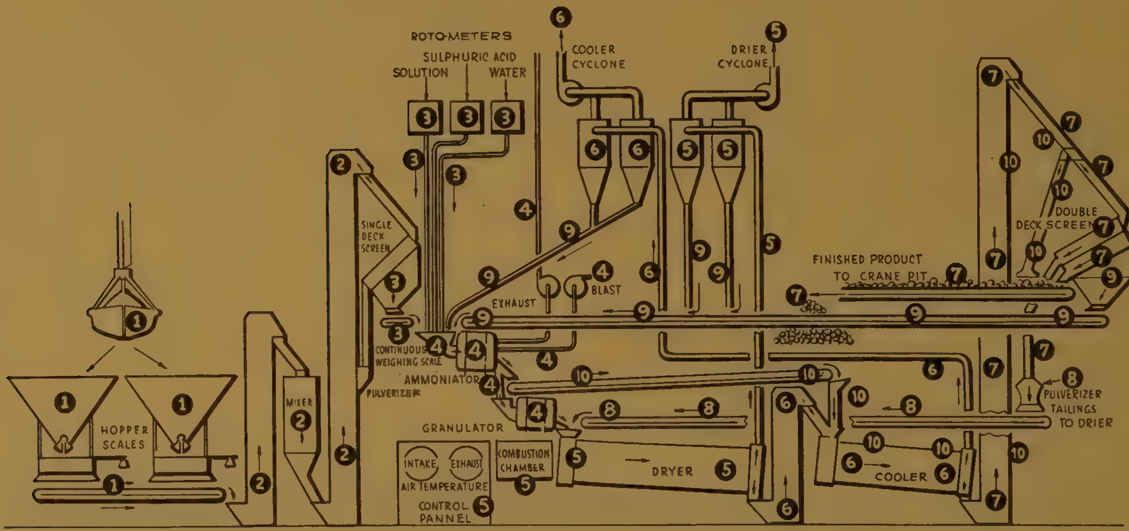


Another view of the ammoniating floor showing conveyor on right, which takes the finished screened product to pit for cranes to carry back to storage and conveyor.



A surge hopper carries the screened dry material and empties into a continuous poidometer for delivery to T.V.A. ammoniator on floor below.

The intake to the TVA ammoniator, showing piping for ammonia, sulfuric acid and water. The dry batch flows into the hopper from the floor above.



Key to Flow Diagram

(1) Supply Hoppers and Batch-Weighing Equipment—Cranes equipped with 2½ yard (approximately 2½ ton) clam-shell buckets pick up the raw materials from bins in the crane-bay and load the overhead large supply hoppers. From these hoppers the required weight of each material called for in the formula is weighed into hopper scales and dumped on conveyor belts which empty into a vertical bucket elevator to lift the materials into the mixer for blending.

(2) Mixing and Screening Unit—All of the dry materials are assembled by batch method and thoroughly blended through a Sackett gravity 1-ton mixer. From the mixer each blended batch is dumped into a vertical bucket elevator and lifted to a single-deck Tyler-Niagara 4′x8′ screen. The screen (4½ mesh) throws out all of the foreign material, sends the over size to a Sackett #15 pulverizer for recycling and conditions the batch for ammoniation. From the screen the blended conditioned batched materials dump into a supply hopper directly over a continuous belt weighing machine.

(3) Solid and Liquid Proportioning Equipment—The continuous operation begins at this stage. The batch blend of solid ingredients is converted to an accurately controlled Poidometer belt scale receiving its feed continuously from the supply hopper directly above. Rotometers and flowraters control continuously the flow of liquid nitrogen solutions, sulphuric acid, and water. The dry materials flow from scalebelt into the ammoniator and the liquids feed into the ammoniator under a deep cascading bed of solid materials.

(4) Continuous Ammoniator and Granulator—The rotary ammoniator and rotary granulator are T.V.A. developed and patent pending equipment. The ammoniator is 7 feet in diameter and 7 feet long, rotates at 8 revolutions per minute and is equipped with 15 H.P. variable speed motor. The granulator is 6 feet in diameter and 8 feet long also rotates at 8 revolutions per minute and equipped with 10 H.P. variable speed motor. Vapors, principal moisture generated by the chemical reaction in the ammoniator, are forced through a stack into the atmosphere by a suction fan equipped with 5 H.P. motor. Sometimes the mixture becomes too wet for rolling, and when this happens air is blown on the bed of material in the ammoniator for some drying. The fan used is equipped with 3 H.P. motor. Most of the granulation takes place in the ammoniator, and the granulator is used for additional rolling of the product.

(5) Drying Equipment—The damp granular product flows from the granulator by chute directly into the dryer. The rotary dryer is 6 feet in diameter and 50 feet long and is driven by a 50 H.P. motor. A co-current 15 million B.T.U.

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AMMONIATION and GRANULATION AT FERTILIZER MANUFACTURING COOP.

By Albert Spillman

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THIS business of granulation is no "Utopia". It takes a great deal of hard work, continuous research and experimenting to continue improving manufacturing methods, formulation and quality.

Although it was anticipated, Fertilizer Manufacturing Cooperative, Inc., had its problems getting started. For several weeks all kinds of difficulties were encountered, Viz: Material from the ammoniator was too wet, too dry, too much oversize, too many fines, too much recycle, chute plugups, pulverizer plugging, screen blinding, too much heat, too little heat, high moistures, not enough cooling, ammonia fumes, cyclone dusting, etc., etc. During this shakedown period, day by day, we were learning more and more about the behaviour of our equipment, finding trouble spots, eliminating previous operating errors, stationing our crew where needed, and getting straightened around on formulation.

Keeping accurate records of operations from day to day, during the startup period, was the real key to getting us started on full production by April 1st, 1955. We are continuing to keep records of each day's operation, showing grade granulated, formula used, water in materials, water added at the ammoniator, ammoniation rate, moisture driven off by drier heat and sulfuric acid, cubic feet of gas consumed per ton of finished product, temperatures, moistures from finished product, cooler, ammoniator, granulator, recycle fines, and oversize; also screen analyses before classifying, finished product, oversize, fines from classifying screen and cyclones. N.P.K. analyses are made once per shift, and the other tests are made periodically through the shift. This control and permanent record work, I am sure, has helped us to stay on the right track as much as any of the other major controls used in our process.

Since starting on full production, April 1, 1955 to June 30, 1955, one eight-hour shift per day, FMCI manufactured 14,000 tons of granular mixed goods. Four grades were made during this period. Most of the tonnage was 10-10-10 and 8-16-16 and a small tonnage of 6-12-12 and 6-18-18. Nitrogen solution carrying 22.2% free ammonia was used in the 10-10-10 and 8-16-16, and nitrogen solution carrying 16.6% free ammonia was used in the 6-12-12 and 6-18-18. Since July 1st FMCI has improved its production operation, using 22.2% free ammonia in 6% nitrogen formulas. Types of nitrogen solution used may have to vary from time to time, depending on the formula desired.

FMCI had no difficulty granulating the higher nitrogen grades 10-10-10 and 8-16-16 by adjusting the water added if the material from the ammoniator was too dry, or by not adding water, or taking out 25 lbs. to 50 lbs. of nitrogen solution and substituting sulfate of ammonia, if the material from the ammoniator was too wet. Lower nitrogen grades 6-12-12 and 6-18-18 were more difficult to granulate. We got nowhere with these grades until we added 100 lbs. of 60° Baumé sulfuric acid to give additional heat to help plasticity and also added considerable water. Since July 1st we have experimented with a coarse potash, almost 100% through 10 mesh and about 85% on 20 mesh, and find we can do a better granulating job with 6% nitrogen mixtures by using a combination fine and coarse or all coarse potash. We have done considerable experimenting with "Minco

(*Continued on Page* 129)

The 4′ x 8′ Tyler-Niagara single deck screen for screening the dry material batch before entering T.V.A. Ammoniator.

Twin dryer cyclones and the double deck Tyler 5′ x 15′ vibrating classifying screen.

Conveyor takes the fines from the cyclones and fines from the classifying screen back to the ammoniator for reworking.

Phytotoxicity of Solvents and Emulsifiers Used in

THE phytotoxicity of insecticidal formulations has been a constant problem for farmers and formulators alike from the time of the first agricultural use of arsenicals to the present day organics. Very often in the early formulations, the phytotoxic agent was the active ingredient itself, especially in the case of the inorganic insecticides. Today, this is generally not the case. Nearly all large chemical companies have elaborate testing laboratories that screen candidate materials for phytotoxic activity as well as insecticidal and fungicidal action. Many times these tests will divert a potential insecticide into herbicide development when it is apparent that the material has phytotoxic properties. Because of this rigid screening, most of the newer organic insecticides are relatively safe to use on plants. There are certain exceptions, as in the case of technical DDT on cucumbers and melons but in general the active ingredient (as sold by the basic manufacturer) is non-phytotoxic. Technical material has little value for agricultural use until it is combined with suitable diluents to make dust formulations, or with solvents and emulsifiers to produce the emulsifiable concentrates used in sprays. Dust formulations, like the technical materials, are generally non-phytotoxic. Emulsion-type sprays, on the other hand, often cause considerable burning of treated plants and are frequently replaced by wettable powders for use in sprays or soil drenches even though the emulsions offer more effective insect control.

While numerous reports have been published on the phytotoxicity of insecticides, only a few have dealt with the phytotoxic properties of one or two solvents or one or two emulsifiers, generally in combination with an insecticide. There is no published information on the phytotoxicity of most solvents or emulsifiers.

At the North Carolina Experiment Station, tests with sprays for corn earworm control and soil drenches for tobacco and cabbage transplants often resulted in such serious burning of the plant that the treatment caused more damage than the insects. Because information on the phytotoxicity of the solvents and emulsifiers was not available, tests were made to determine the relative toxicity of these materials to plants. These tests were designed to determine the plant's reaction to the solvents or emulsifier itself and not to a formulation containing an insecticide.

Representative samples of most of the commercially available solvents and emulsifiers were obtained from the manufacturer or purchased on the open market. A total of seventy-seven emulsifiers and eighty-six solvents were used in the tests. All of the emulsifiers and most of the petroleum base solvents are referred to by their trade names. The reason for this is that the exact chemical composition of the material is not always known or else the information is classed confidential by the manufacturers.

Essentially, the testing procedure was the same for both the solvents and emulsifiers. This consisted of making water emulsions or solutions of the material and applying it to the foliage of seedling plants. Six different species of plants were used. These were:

Plant	*Variety*
Sweet Corn	Ioana
Cucumber	Long Green
Cotton	Coker 100
Lima Bean	Fordhook 242
Tobacco	Dixie Bright 101
Tomato	Marglobe

All of the plants were grown in individual pots under greenhouse conditions that produced very tender foliage. The plants were tested when they were approximately four inches in height, thus the slower growing tobacco and tomato plants were slightly older than the more rapidly growing corn and cucumber. As one group of plants were tested, another group of seeds were planted for future use. At least three replicates were used for each species of plant for each material at each concentration tested. Because of this large number, all plants could not be tested simultaneously. Two or three species of plants would be tested with all the emulsifiers or all the solvents at one time, the other species being tested in succeeding weeks. Each of the three replicates for each species was made during different weeks using plants grown at different times.

The plants were treated by quickly dipping the foliage into solutions of the emulsifiers or emulsions of the solvents. Emulsifiers were tested at one percent and one-tenth percent concentration, on a volume to volume basis. The solvents were tested at five percent and five-tenth percent, on a volume to volume basis. In testing the solvents, it was necessary to formulate them with an emulsifier. Because no one emulsifier would emulsify all of the different types of solvents, a mixture of two materials was selected and used with all solvents. The two emulsifiers, Triton X-177 and Atlox 3335, were chosen because of their low phytotoxicity in the emulsifier tests, and because one emulsified straight chain hydrocarbons while the other emulsified the aromatic compounds. The formulations were made to contain 10% emulsifier and 90% solvent. The tap water used in all tests had a pH of 7 and a hardness of 30 to 45 ppm of combined calcium and magnesium salts. All solutions and emulsions were made fresh for each test.

In addition to the foliage tests, root tests on emulsifiers were made with tomato and tobacco plants. The plants were started in soil and later transferred to a nutrient solution when they were about four inches high. After being conditioned to the nutrient solution for two weeks, the plants were placed in the test solutions. These test solutions were made

Insecticide Formulations

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of nutrient solution to which varying concentrations of emulsifier had been added, using a separate bottle for each concentration of each emulsifier. Only one replicate for each material was used in the root tests. After treatment, all plants (root tests and foliage tests) were held in a constant temperature room for one week at 90°F. and a relative humidity of 75 percent. During this time, the pots of the foliage test plants were held in trays containing a half-inch of water. Banks of flourescent lights suspended directly above the trays provided sufficient light to prevent chlorosis.

At the end of the holding period, the plants were rated for injury, using the following values: 0 = no visible sign of injury, 1 = very slight injury, 2 = moderate injury, 3 = heavy injury, and 4 = severe injury, usually a dead plant. The readings of the three replicates were averaged for the rating of the material. In nearly all cases there was very close agreement among the three replicates. In cases where the reading varied greatly, additional tests were made and in some instances as many as six replicates were used.

Simple cream out tests were made with the emulsifiers to gain some indication as to their emulsifying properties. Each emulsifier was mixed with three separate solvents: kerosene, xylene, and methylated naphthalene (Velsicol AR-50) in a one to ten volume ratio. After the solution was mixed thoroughly, one ml. was placed into nineteen ml. of tap water in a test tube and the stoppered tube inverted three times. Observations were made at the end of one, five, fifteen, thirty, and sixty minutes. The time of the first observable cream line was recorded, but no distinction was made between a heavy cream and a complete separation of the solvent phase.

The results of the tests are shown in tabular form.

It is not possible to generalize on the relation of chemical structure to the phytotoxicity of the different solvents or emulsifiers, because the structures were not always known. The terms used in describing most of the emulsifiers were similar to, "aryl-alkyl" or "mixed esters of higher fatty acids", terms which actually tell nothing of the structure of the material. The structures of the solvents are more definite in the case of the non-petroleum types, but with the petroleum fractions, the best description of the material is the boiling point and this again tells little about the chemical structure.

With the emulsifiers, it may be pointed out that the effective emulsifying agents are generally the more phytotoxic. In all probability, this is due to the ability of the better emulsifiers to penetrate the leaf tissue and perhaps combine with the protoplasm more readily than the less effective emulsifiers. In the foliage tests, the most susceptible plant was cucumber followed by tomato, corn, cotton, bean and tobacco being the least susceptible. The roots were about ten times as susceptible as the foliage to injury, that is the roots required one tenth the concentration as the foliage to show equivalent injury. The tomato roots were much more susceptible to injury than the tobacco roots.

The one percent concentration used in testing the emulsifiers was about ten times greater than the highest concentration normally encountered in agricultural sprays. Thus the fact that a material showed considerable injury at the one per cent level does not prohibit its agricultural use, but it does mean that some phytotoxicity may result if the material is used above the recommended rates. In any event, those materials that showed no injury at the one percent level would be a better choice. Those materials that showed injury greater than a rating of 0.1 at the tenth concentration should be considered hazardous for agricultural use. It must be remembered that the tests were conducted under conditions most favorable for injury to develop and that many of the materials that showed injury in these tests might never show it in the field. In addition to the highly susceptible plants, the lack of solvents and toxicants in the formulations may have influenced the phytotoxicity of the emulsifiers. Normally, in an insecticidal formulation much of the emulsifier is combined with the solvent or active material and would be less available to cause plant injury.

It is apparent that the petroleum distilates are considerably more phytotoxic than the other types of solvents. Atlantic Solvents 52 and 53 were the only petroleum materials tested that had an average rating of less than one at the five percent concentration, all the other petroleum solvents having averages considerably greater than this. The acetates, alcohols, ketones, and ethers were in general non-phytotoxic until four or more units were in the carbon chain. The butyl radical appeared to be quite toxic, and tributyl phosphate killed all plants even at the low concentrations. The addition of chlorine or phosphorous to the molecule also tended to increase the phytotoxicity. The more water soluble the solvent, the less likely it is to cause plant injury; and those materials that are water insoluble in general are highly phytotoxic.

Some question may arise as to the effect of the emulsifier on the phytotoxicity of the solvents. The two emulsifiers used in all solvent formulations were among the least toxic of all emulsifiers tested. That they had no direct effect on the ratings of the solvents is demonstrated by the fact that the lower alcohols and ketones

(*Continued on Page* 137)

Emulsifier Tables on pages 44-45. Toxicity data on Insecticidal solvents on pages 136.

PHYTOTOXICITY RATINGS OF EMULSIFIERS

Trade Name	Foliage Tests														Root Tests						Cream out Tests		
	Bean		Corn		Cotton		Cucumber		Tobacco		Tomato		Average		Tomato				Tobacco		Time in Mins., less than		
	1.0%	0.1%**	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	.1%	.01%	.001%	1.0%	.1%	Xylene	AR50	Kerosene
Atlas NNO	0	0	0.66	0	0	0	0.33	0	0.5	0	1.0	0	0.42	0	1	0	0	0	2	0	1	1	1
Atlox A52	2.33	1.5	2.5	2.5	2.33	0	2.66	1.66	0.5	0	2.33	0	2.11	0.94	0	0	0	0	0	0	1	1	1
1045-A	0	0	0	0	0	0	0.66	0.33	0	0	0.66	0	0.22	0.06	0	0	0	0	0	0	5	15	5
1087	0.33	0	0.33	0	0.33	0	1.0	0	0	0	0.33	0	0.39	0	0	0	0	0	0	0	1	1	1
1256	0	0	0.33	0	0.66	0	0.33	0	0	0	0.33	0	0.28	0	1	0	0	0	0	2	1	5	5
2080	0.33	0	1.66	0.5	1.0	0	4.0	0.33	1.0	0	1.33	0	1.56	0.14	4	4	1	0	2	0	30	15	1
2081	0	0	1.0	0	1.66	0	2.0	0	1.5	0	0.33	0	1.07	0	4	1	0	0	4	1	5	15	1
2085	0	0	0.33	0	0.33	0	1.0	1.0	0	0	0.66	0	0.55	0.17	4	0	0	0	1	3	5	30	5
3300	1.0	0	3.66	0.5	1.0	0	3.66	0	2.5	0	1.66	0	2.25	0.08	4	4	4	1	4	0	15	30	1
3335	0	0	0.33	0	0.66	0	0.33	0	0	0	0	0	0.22	0	4	4	0	0	0	0	+60	+60	1
8916-P	0	0	0.33	0	0	0	0.66	0	0	0	0.66	0	0.28	0	0	0	0	0	0	0	5	15	1
Cooper ATX-26	0.6	0	2.6	0	1.0	0.5	3.5	0	1.0	0	4.0	1.0	2.12	0.25	4	4	0	0	4	3	1	+60	1
ATX-27	3.6	0.5	1.6	0	4.0	1.0	2.0	0	1.0	0	4.0	0	2.70	0.25	4	0	0	0	4	0	+60	+60	1
ATX-45	2.0	0	2.5	0	1.6	0	4.0	0.3	1.0	0	4.0	0	2.68	0.05	0	0	0	0	2	3	+60	+60	1
ATX-60	0	0	2.5	0	1.3	0	2.6	0	1.0	0	2.5	0	1.65	0	4	4	0	0	3	4	1	+60	1
CTX-54	1.3	0	4.0	0.5	1.6	0	4.0	0.6	1.0	0	4.0	0	2.65	0.18	0	0	0	0	0	0	+60	+60	1
Darvan 1	0.5	0	0	0	0	0	0	0	0	0	0.3	0	0.13	0	3	0	0	0	1	0	1	1	1
2	0	0	0	0	0.3	0	0	0	0	0	0	0	0.05	0	4	0	0	0	2	0	1	1	1
D-Sperso-W	1.3	0	2.6	0	1.3	0	3.3	0.3	0	0	3.0	0	1.92	0.05	4	4	0	0	4	3	5	5	1
Emcol H-44-C	0	0	1.0	0	0	0	0.3	0	0	0	0.6	0	0.32	0	0	0	0	0	0	0	5	5	15
H-65-C	0.6	0	2.0	0	0.3	0	0.6	0	0.5	0	2.0	0	1.00	0	4	0	0	0	4	4	5	5	5
H-77	0	0	0.3	0	0.3	0	0.25	0.5	0	0	1.0	0	1.63	0.08	4	1	0	0	4	4	1	1	1
H-82	0.3	0	1.3	0.5	1.0	0	1.6	0	0	0	0.6	0	0.80	0.08	4	4	0	0	2	1	5	+60	1
H-83-A	0.6	0	2.6	0	1.3	0	2.6	0	1.0	0	0.5	0	1.43	0	4	1	0	0	3	3	1	+60	1
H-83-T	0.6	0	2.3	0.5	1.0	0	2.0	0	0.5	0	0.6	0	1.67	0.08	4	4	3	0	3	3	30	+60	1
H-84-T	0.3	0	2.6	0	2.0	0	3.3	0	0	0	1.6	0	1.60	0	4	2	0	0	0	0	+60	+60	1
H-85-A	0.3	0	1.3	2.0	1.6	0	3.6	0	0.5	0	2.0	0	1.55	0.33	4	2	0	0	0	0	+60	+60	1
H-85-T	0.6	0	1.6	.5	1.3	0	3.0	0	0.5	0	0.3	0	1.22	0.08	4	4	1	0	3	1	+60	+60	1
H-88	0.3	0	2.0	1.0	1.3	0	4.0	0	0.5	0	1.3	0	1.57	0.16	4	2	0	0	4	1	30	+60	1
H-89	0	0	2.6	0.5	1.6	0	3.0	0	1.0	0	3.0	0	1.87	0.08	4	4	0	0	3	0	60	60	1
H-92	1.0	0	2.0	0	1.0	0	1.6	0	0	0	1.6	0	1.20	0	4	4	0	0	1	1	1	60	15
H-140	0	0	2.0	0	1.0	0	2.0	0	0	0	1.6	0	1.10	0	4	4	0	0	2	1	1	1	1
H-141	0	0	1.0	0	1.3	0	0.6	0	0	0	0.6	0	0.58	0	4	4	0	0	2	1	1	1	1
H-400	0	0	2.5	1.0	1.3	0	2.3	0	0.5	0	1.3	0	1.32	0.16	4	4	0	0	3	1	1	15	1
H-500	0.3	0	1.0	0	1.0	0	3.0	0	0	0	2.0	0	0.77	0	4	4	0	0	3	1	5	+60	1
Emulphor VN-430	0	0	0.6	0	0	0	0.6	0	0.5	0	0.3	0	0.33	0	0	0	0	0	0	0	1	1	1
EL 620	0	0	0	0	0	0	0.3	0	0	0	0	0	0.05	0	1	0	0	0	0	0	5	5	1
EL 719	0	0	0.3	0	0.3	0	0.6	0	1.0	0	0.6	0	0.47	0	2	0	0	0	0	0	1	15	1
Emulsol 87-33	0	0	0.6	0	1.3	0	1.6	0	1.0	0	1.0	0	1.09	0	4	2	0	0	4	3	1	+60	1

*Rating values: 0=no injury, 1=slight injury, 2=moderate injury, 3=heavy injury, 4=severe injury or dead plant.
**Concentration of emulsifier in solution.

	Bean		Corn		Cotton		Cucumber		Tobacco		Tomato		Average		Tomato				Tobacco		Time in Mins., less than		
	1.0%	0.1%**	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	0.1%	1.0%	.1%	.01%	.001%	1.0%	.1%	Xylene	AR50	Kerosene
Igepal																							
CO-430	0.3	0	0.3	0	1.0	0	1.6	0	0	0	3.3	0	1.42	0	0	0	0	0	0	0	1	1	1
CO-530	3.0	0.5	4.0	0	2.3	0	4.0	0.3	0.5	0	3.6	0	2.90	0.13	2	0	0	0	3	0	1	1	15
CO-630	2.6	0	4.0	0.5	3.0	0	4.0	1.6	1.0	0	4.0	1.0	2.77	0.52	1	0	0	0	0	0	30	60	1
CA-710	3.6	0.5	3.6	0.5	3.0	1	4.0	1.0	1.0	0	3.6	1.0	3.13	0.66	4	4	0	0	1	0	5	15	1
CO-710	3.0	0.5	3.6	0.5	2.6	0	4.0	1.0	0.5	0	4.0	1.0	2.95	0.50	4	0	0	0	0	0	1	15	1
Marasperse C	0	0	0	0	0	0	0	0	0	0	0.5	0	0.08	0	4	0	0	0	0	0	1	1	1
CB	1.0	0	0	0	0	0	0	0	0	0	0.3	0	0.21	0	1	0	0	0	0	0	1	1	1
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	1	1	1
Monsanto Emulsifier L	0	0	2.3	0.5	1.66	0	2.0	0	1.0	0	1.33	0	1.38	0.08	4	4	1	0	1	2	15	+60	1
Nonic 218	3.33	0.5	3.66	0	2.66	0	4.0	1.0	1.0	0	3.66	1.0	3.05	0.13	4	4	0	0	1	1	5	5	1
234	3.0	2.0	3.66	0.5	2.0	0	4.0	0.5	1.0	0	3.66	1.0	2.89	0.75	4	4	0	0	1	0	5	5	1
261	4.0	0.5	4.0	0	3.33	0	4.0	0	2.5	0	4.0	0	3.64	0.08	4	4	0	0	1	0	1	1	15
Remsen Emulsifier 202	0	0	1.66	0	1.0	0	1.33	0	0.5	0	0.66	0	0.86	0	1	0	0	0	0	0	1	+60	1
Santolene C	0.33	0	3.0	0	0.66	0	3.0	0	0.5	0	1.33	0	1.47	0	4	4			0	0	1	1	1
Sterox AJ	4.0	2.0	3.22	0.5	2.66	0	4.0	1.0	1.0	0	4.0	0	3.15	0.60	4	4	4	1	0	0	5	5	5
CD	0	0	0.33	0	0.66	0	1.33	0	0	0	0.33	0	0.44	0	0	0	0	0	0	0	1	5	1
SK	4.0	0.5	2.5	0	2.33	0	4.0	0.66	1.5	0	4.0	0	3.06	0.19	3	2	4	0	2	3	1	1	15
Tenlo 10	0	0	1.0	0	1.0	1.0	0.66	0	0	0	1.6	0	0.71	0.13	4	0	0	0	1	3	1	1	1
46A	0	0	0	0	0	0	0.33	0	0.5	0	0	0	0.16	0	4	0	0	0	0	1	1	1	1
400	1.0	0	1.0	0	1.66	0	1.33	0	0.5	0	2.0	1.0	1.25	0.13	4	0	0	0	2	0	1	1	1
Thiosolve	0.3	0	1.0	0	0	0	2.0	0	0	0	1.0	0	0.72	0	0	0	0	0	0	0	1	5	1
Trem 014	0	0	0.33	0	0.33	0	0.33	0	0.5	0	0.33	0	0.31	0	0	0	0	0	1	0	15	15	5
024	1.33	0	0.66	0	1.0	0	2.33	0.33	1.0	0	1.66	1.0	1.13	0.22	4	1	0	0	1	0	1	1	+60
618	0	0	0.66	0	0.66	0	0.33	0	0	0	1.0	0	0.44	0	0	0	0	0	4	0	1	1	15
Trex 40	1.33	0	0.66	0	1.0	0	2.33	0.33	1.0	0	1.66	1.0	1.33	0.22	4	1	0	0	4	0	+60	+60	1
Triton B-1956	0.33	0	0	0	0	0	0	0	0	0	0.33	0	0.11	0	0	0	0	0	0	0	1	1	1
X-45	3.33	0	4.0	0.5	2.66	0	4.0	1.33	1.0	0	4.0	2.0	3.13	0.63	3	0	0	0	3	0	1	1	1
X-100	4.0	2.0	4.0	0.5	2.66	2.0	4.0	2.0	0.5	0	4.0	1.0	3.18	1.25	4	4	1	0	1	0	5	60	1
X-120	1.66	0	2.33	0.5	2.33	0	3.66	0	1.0	0	3.0	0	1.13	0.08	4	4	0	0	0	4	5	5	1
X-150	2.6	0.5	2.5	2.0	2.0	0	4.0	1.55	0.5	0	3.33	1.0	2.50	0.83	4	4	0	0	0	0	30	30	1
X-151	3.0		4.0		3.0		4.0		0		3.0		2.90										
X-155	0	0	0.66	0	0	0	0.5	0	0	0	0	0	0.19	0	0	0	0	0	0	0	30	15	1
X-160	0	0	1.25	0.5	1.0	0	1.66	0	0	0	1.0	0	0.82	0.08	4	4	0	0	1	0	30	+60	1
X-171	0.3		4.0		0		0.5		0		0		0.60										
X-177	0	0	0	0	0	0	1.66	0	0	0	1.33	0	0.60	0	4	4	0	0	2	1	1	+60	+60
X-188	2.66	0	3.66	0	2.0	0	3.66	0.33	0.5	0	3.33	1.0	2.69	0.22	4	3	0	0	4	0	1	5	1
Vatsol OTB	2.0	0	3.66	0	2.66	0	4.0	1.66	3.5	0	2.33	0	3.19	0.28	4	4	4	0	2	2	1	1	1
Veegum	0	0	0.30	0	0	0	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0	1	1	1

*Rating values: 0=no injury, 1=slight injury, 2=moderate injury, 3=heavy injury, 4=severe injury or dead plant.

**Concentration of emulsifier in solution.

estimating the ability of soils to supply nitrogen

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THE great increase that has occurred in recent years in the production of chemical nitrogen has markedly stimulated the interest of farmers in rapid tests, or procedures, for estimating probable release of available nitrogen from soils. The primary need is for a method that will show whether a given soil will deliver 25, 50, 100 or more pounds of nitrogen to a specified crop during a growing season. Such information enables the grower to decide quickly how much nitrogen will be required in a normal season to produce a desired crop yield. For example, if the aim is to produce 100 bushels of corn per acre, and the soil furnishes only 75 pounds of nitrogen, then an additional 125 pounds must be supplied as fertilizer. These figures are based on the assumption that two pounds of nitrogen are required to produce a bushel of corn. In practice, this goal may not be reached if nutrients other than nitrogen are deficient, if the soil or climate is not suitable for the crop, if leaching is excessive, or if an attempt is made to obtain very high yields.

The extent to which it is now possible to estimate the probable release of available nitrogen from a soil, and some of the problems that arise, are discussed below.

First, it is well to consider what constitutes available nitrogen. To the majority of agriculturalists this means nitrate, and this is probably the best cource of nitrogen under a variety of conditions. Ammonia is, however, excellent for most crops unless the soil is distinctly acid. In neutral soils, many crops either prefer ammonia to nitrate, or grow best when both forms of nitrogen are available to them. Some simple organic compounds, such as urea and amino acids, are also absorbed by plants but are seldom present in appreciable concentrations, and are of minor importance unless added from outside sources. They are rapidly decomposed by soil organisms.

Nature of Soil Nitrogen

THE nitrogen compounds in soil humus are very heterogeneous in nature and resistant to biological attack, or else they would have disappeared long ago. Our information on the nature of these compounds is still far from complete. The chief constituents are believed to be proteins, amino acids, nucleic acids, chitin, heterocyclic compounds, and lignoprotein complexes. Some of these compounds are so intimately bound with clay that they are largely free from biological attack. Some soils also contain clay minerals that fix small amounts of ammonia in an unavailable form, but usually nearly all soil nitrogen is present in organic forms.

In addition to the nitrogen in soil humus, there is always a varying percentage of nitrogen present in recently added crop residues. A portion of this nitrogen may or may not become available readily, depending upon the carbon - nitrogen ratio, or per cent nitrogen present, and on the resistance to biological attack.

Release of Available Nitrogen

NITROGEN is ordinarily released (2, 8, 12) from soil organic matter to cultivated crops to the extent of about 1 to 3 per cent during each growing season, although sandy soils may yield somewhat higher percentages. The microorganisms that are primarly responsibie for this release are the ammonifiers. The ability to form ammonia from many organic compounds is a property that is common to the majority of soil microorganisms. This ammonia is then oxidized to nitrate by the nitrifying bacteria, *Nitrosomonas* and *Nitrobacter*. The bottleneck in the process of going from soil humus to nitrate is the slow rate of release of ammonia from the resistant organic matter. The nitrifiers are capable of oxidizing many times more ammonia than they commonly do. It is only when the nitrifying bacteria are absent, which occurs rarely, or when soil conditions are unfavorable for growth, that nitrate formation from ammonia is prevented or greatly retarded.

The resistance of soil humus to biological attack is actually very fortunate in most respects since humus is more valuable in maintaining soil tilth than it is as a source of nitrogen. Any nitrogen needed in addition to that supplied by the soil can, of course, be obtained at moderate costs from commercial sources.

The factors that affect the rate of release of available nitrogen are chiefly (a) the nature of the soil organic matter and the degree to which it is protected by clays, (b) temperature, (c) moisture, (d) aeration, (e) reaction, (f) supply of inorganic nutrients, and (g) nature of the soil microflora. The primary need of the ammonifying organisms is for a source of energy. If a substance such as protein is attacked, much more nitrogen is set free than the microorganisms need. On the other hand, if a material such as straw with a nitrogen content of 0.5 per cent is undergoing decomposition, the supply of available nitrogen may be decreased, and the crop may show nitrogen deficiency. If the nitrogen content is greater than 1.5 to 2.0 per cent, then usually any nitrogen above this level will be released to the growing crop.

Methods in Use or Proposed

A satisfactory method for determining release of available nitrogen from a soil that can be used in a practical way should be simple, reasonably accurate, and inexpensive. Very accurate values are not needed and, theoretically, are not obtainable. This is true because, as already stated, nitrogen is made available by microorganisms; and the conditions for their growth vary with season, with kind of crop, and even with the same crop planted at different times, and given different cultural treatments. All that can be expected is to obtain an average value for probable nitrogen release from a given soil to a specified field crop.

Four types of methods are in use, or have been proposed for measuring probable nitrogen release from soils. These are (a) vegetative tests, (b) nitrification tests, (c) release by chemical reagents, and (d) determination of total nitrogen either directly or indirectly by measuring total organic matter. In addition, plant tissue tests for nitrate nitrogen are of value, but consideration of such tests falls outside the scope of the present discussion.

Vegetative tests. — The most direct and reliable method of determining the release of available nitrogen to a crop by a given soil is, of course, to conduct a field plot experiment on the soil and determine nitrogen uptake. This method can be used to only a limited extent, because of the time and expense involved. Field tests using different rates of nitrogen additions are, however, needed to serve as a basis for the interpretation of values obtained by more rapid methods.

Vegetative tests, similar to field experiments, may be conducted in the greenhouse. If such experiments are conducted between crop seasons, there is a gain in time over the field plot method, but the expense involved limits greatly the number of soils that can be tested. There is also the added disadvantage that the stirring and drying of the soil accelerates the normal rate of release of available nitrogen to the crop. Values obtained by this method are likely to be higher than those obtained in the field, but this is determined to some extent by the conditions in the greenhouse and the duration of the experiment. Such experiments, like field tests, are of great value in the standardization of laboratory soil tests.

Nitrification tests. — A simple and more rapid biological technique for determining release of available nitrogen is the nitrification test (1, 4, 5, 6, 7, 10). In this method, as used at the Iowa Experiment Station, a small quantity of soil is incubated at 35° C. for two weeks and nitrate accumulation determined. The conditions are in many, but not all, respects similar to those found in nature. It has been shown repeatedly that the availability of nitrogen in soils may be measured nearly as satisfactorily by determining nitrate accumulation in the laboratory as by growing a crop in the greenhouse and determining its nitrogen content. Exactly the same agents that are responsible for making the nitrogen available are active under the two conditions; the end product is merely measured differently.

The obvious advantages of the nitrification procedure are many; the difficulties are chiefly those of technique and interpretation of the values in terms of the farmer's nitrogen needs for the crop to be grown. In order to emphasize some of the complications involved, it is well to refer to the more important factors and questions that need to be considered in the use of the nitrification procedure. These are as follows:

1. A standardized system of treatment of soil samples following removal from the field should be followed. If, for example, they are shipped wet, considerable nitrification may occur in transit, resulting in low test values.

2. The incubation conditions with respect to moisture and aeration should be optimum. Temperature should be kept constant but whether this should be sufficient to give the maximum rate of nitrate production, or whether it should be more nearly the average of field soil temperatures, is not known with certainty. A temperature of 35° C. is now in common use, since at this temperature the incubation period can be made as short as two weeks.

3. Nitrification in acid soils is usually markedly increased by additions of lime. If such additions are not made, low nitrate values obtained in the laboratory may be interpreted as indicating a need for large applications of nitrogen when the more important need is for ground limestone. Such soils should be tested both with and without addition of lime.

4. The incubation period affects somewhat the nitrification values for different soils; hence, there is no perfect time period. As a practical matter, it must be as short as possible, since even the two-week period is sometimes a handicap to the use of the method. A short period may unduly emphasize the immediately available portion of the soil nitrogen, but this effect is not very serious, since all soils are treated alike.

5. Should nitrates only, or nitrates plus ammonia be determined? Sometimes soils are encountered that either contain no nitrifying organisms, or such a limited number that not all of the ammonia formed is ox-

Unless soils are distinctly acid, ammonia is considered an excellent source of available nitrogen. Crops in neutral soils may under certain conditions prefer ammonia to nitrate or grow best when both forms are available.

idized in the time available. Low nitrate values obtained with such soils might be misleading, since both nitrate and ammonia are good nitrogen sources for plants.

6. The interpretation of the results obtained is frequently difficult largely because of varying climatic conditions, and also lack of sufficient vegetative tests against which the nitrification results can be standardized. The recent cropping practices may also influence the succeeding crop responses more than they do the nitrification test. This is especially true where a deep-rooted legume has been grown.

Because of the numerous factors involved there can, obviously, be no perfect procedure that meets all objections. The Iowa workers have, however, perfected the nitrification method to the point where it is being used with good success as a routine procedure.

Chemical release of available nitrogen. — Truog and associates (7, 11) have studied a chemical method similar to the ones used with reasonable success for many years in the fertilizer industry for estimating the availability of nitrogen in natural organic materials. In this method, a small sample of soil is boiled for five minutes in alkaline permanganate and the ammonia that is released is determined.

Truog's method has the advantages of being simple, rapid, and inexpensive. The results should be closely reproducible by various workers, and be less affected by the preliminary handling of the soil than would tests involving either higher plants or microorganisms.

The chief uncertainty, and a very big one, with respect to chemical methods centers around the effectiveness of chemical reagents in liberating the same portion of the soil nitrogen that natural agencies release to the crop. Actually, it is well known that no chemical agent can duplicate the activities of numerous and ever-changing biological agents. But this may not be too serious an objection for, as stated above, biological methods are also far from exact, and the results must be standardized against vegetative tests.

Any chemical method must necessarily be an empirical one, and will be affected by types of organic nitrogen present, amounts and types of clay, and quantity of fixed ammonia held by clay minerals. Chemical methods also are not to be expected to measure the depressing effect of carbonaceous residues on nitrogen availability. These methods are still in the experimental stage and can not be recommended until their value has been adequately demonstrated as applicable to soils of the type under consideration.

Total nitrogen or total organic matter. — It has been shown (1, 3) that for any given soil series, there is usually a fairly close correlation between total nitrogen and the quantity made available annually. This indicates a similarity in composition of the native organic matter, regardless of past cropping practices. If this proves to be true generally, then the total nitrogen determination could be used as a basis for predicting release of available nitrogen. Since this determination is not simple, a less expensive substitute method is needed even though probably not as good. Such a substitute procedure is the determination of soil organic matter, which usually has a fairly constant carbon-nitrogen ratio in a given climatic zone. Fortunately, this determination is fairly rapid and is now commonly made in soil testing laboratories.

The Missouri Agricultural Experiment Station (9, 12) has had much experience in estimating crop needs for nitrogen from soil organic matter determinations. Smith (9) points out that the amount of nitrogen that a soil will deliver to a crop such as corn will depend very much on its texture. A clay or clay loam will release 1¼ to 2½ per cent of its total nitrogen in one season, a silt loam 1½ to 3 per cent, and a sand or sandy loam 4 to 6 per cent. He also emphasizes the importance of temperature and moisture conditions during the growing season, as well as the nature of any organic matter recently turned under. In estimating nitrogen needs by this procedure, the Missouri station takes into consideration as many of the factors as it is possible to know or estimate in advance. These include any recently added animal manures or crop residues.

This discussion has emphasized that progress has been made during recent years in the development of satisfactory practical procedures for predicting probable release of available nitrogen from cropped soils. Additional research is needed, however, and large numbers of comparisons of laboratory and field results must be made in order that laboratory values will have a more quantitative meaning in terms of various cropping practices on the soils of a given region. Yearly variations in climate, which are of course not known in advance, increase the difficulties of predicting the probable release of nitrogen from soils. Nevertheless, reasonably satisfactory results are now being obtained by the nitrification procedure, and more extensive work with chemical tests may prove that they are also valuable. Furthermore, the possibility of making estimates of nitrogen release based on total nitrogen or organic matter, as done at the Missouri Experiment Station, is also intriguing and the procedure merits thorough study.★★

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*At the Alabama Pest Control Conference, Auburn, Ala., Feb. 24, 1956.

HAZARDS

in Connection with Pesticide Use

By H. L. Haller

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MANY new chemicals have been developed in recent years to control destructive insects, fungi, weeds, and nematodes. Most of these new pesticidal materials are synthetic organic compounds, and some are highly poisonous to man. But this does not necessarily mean that they present a hazard to man and his domestic animals. There is a tendency by some automatically to confuse "poisonous" with "hazardous." The two terms are not synonymous. A poison is a substance that has the capacity of producing injury; hazard is the probability that injury will result from the use of the substance in the quantity and in the manner recommended.

The first question we need to consider is the extent of the hazards presented by pesticides. The score or so of accidents attributed to pesticides are statistically insignificant when compared to the four million home accidents causing 28,000 deaths last year. Yet the use of pesticides does present hazards, and precautions are necessary. For convenience the hazards may be divided into four classes:

(1) Hazards of manufacture and formulation;
(2) Hazards of application or use;
(3) Hazards of pesticide residues on food;
(4) Hazards to persons exposed incidentally.

Poisoning occurs in all these classifications and it is not confined to the newer insecticides. Both acute and chronic cases of lead poisoning, caused by the use of lead arsenate are known, although today poisoning from this source occurs less frequently. Pyrethrum is of a low order of human toxicity and generally it is regarded as free of hazard. But there are cases of allergy to pyrethrum, showing that no material is safe under all conditions. It hardly seems necessary to say that any person who plans to use a pesticide should inform himself of its characteristics and govern himself according to directions.

Hazards of Manufacture and Formulation of Pesticides. — The manufacture of the basic pesticidal chemicals presents little hazard because of the industry's safety precautions. From the start of volume production of highly toxic compounds, industry's safety engineers always study the toxicity of the several intermediate chemicals needed to produce the pesticidal chemical and devise ways to protect the workers. Management requires strict adherence to the precautionary measures. When personnel in the plant of a basic producer suffers injury today, it usually is a true accident caused by failure of mechanical equipment.

In the preparation of liquid formulations, the solvent is of great importance, for one or more solvents frequently make up the bulk of the liquid preparations. Solvents with a high inherent toxicity should be avoided and the operation should be carried out under a hood or in a well ventilated room. Another danger inherent in many solvents is their flammability. When working with such solvents, spark proof motors and electric switches are essential.

Dusts and diluents for dry formulations should be selected for minimum toxicity. In particular the percentage of free silica and talc should be held to a minimum. Talc is one of the few silicates known to cause silicosis. There is not much danger of silicosis to the occasional user of dusts, but the exposure of the commercial applicator or mixing plant worker may be significant. In addition to the threat of silicosis, all dusts are somewhat irritating to the respiratory tract. For this reason, and because of the toxicity of the active ingredient, the development of wettable powders containing anti-dusting agents is important. When such powders are used, the worker who mixes suspensions in the field encounters much smaller concentrations of the powder in the air.

Hazards of Application or Use of Pesticides.—Of greatest concern, perhaps, have been the health hazards that face the applicator in the field. Because field work varies so greatly, precautions cannot be outlined as specifically and as extensively as is possible in factory production. This means there would seem to be no place for casual unskilled labor in work which brings them into contact with dangerously poisonous materials. Selection, education, and training would appear to be the most satisfactory way for reducing hazards. Elaborate label requirements are of little value if containers carrying instructions for proper use are handled by individuals incapable of following directions. Containers should not be too large, they should be easily handled and should have pouring spouts for liquid preparations. Powders normally may offer a greater hazard than liquids, but accidentally spilling highly poisonous liquid materials on the skin can be much more serious. Empty containers, both metal and paper, should be disposed of safely. Paper containers can be burned, and metal containers can be punctured to prevent reuse.

For safe mixing of dry powders and liquid concentrates, the equipment used in the field should be properly designed and facilities adequate. Evidence from the work on lead arsenate and with the newer products shows that air around a mixing point may be ten times as contaminated as in the area where the product is applied. Many of the serious accidents have been among the mixers, both as the result of inhalation and skin absorption. In applying sprays and dusts it should be remembered that only fine particles are inhaled. A cloud of fine particles may constitute only a minor fraction of the spray or the dust, but it can be a serious health hazard.

A number of respiratory devices have been developed and made commercially available to protect individuals from the health hazard of dusts, insecticidal sprays and aerosols during mixing operations or field use. This has been accomplished as a result of a cooperative program between government and industry. Devices are available for protection not only against the chlorinated hydrocarbons and the organic phosphates, but also against some substances, not ordinarily considered harmful, which can cause permanent harm and even death, if they are inhaled with frequent regularity or over long periods.

Respirators are intended for outdoor use to protect the wearer from low concentrations of dusts, mists, and vapors. They are not sufficient, however, during the formulation or mixing of insecticides or during indoor application of toxic materials. Full face gas masks should be worn on such occasions. Personnel should be supervised to see that respirators are cleaned at the end of each day's wear and that they are kept away from the areas where toxic materials may be present. It is also important that filters and absorbents be replaced regularly with new ones. Each operator should be provided with a respirator for his own personal use. Facilities should also be provided for removal of clothing in the event it becomes wetted with some pesticidal preparation which may be absorbed through the skin. The U.S. Department of Agriculture has issued a list of respirators and gas masks that have been tested and found satisfactory for protection against most of the chlorinated hydrocarbon and organic phosphate insecticides. A copy of the list may be had by writing to me.

Hazards of Pesticide Residue on Food.—The question of residues on foods has become important from the point of view of the consumer, and every effort is being made to prevent undue contamination.

Much publicity was given to the problem, first through the hearings conducted in 1950 by the Food and Drug Administration in connection with the establishment of legal tolerances for pesticide residues on fresh fruits and vegetables, and more recently by hearings before a Congressional committee investigating chemicals in foods. These hearings culminated in the passage of the so-called Miller Bill officially known as Public Law 518. This law, an amendment to the Federal Food, Drug, and Cosmetic Act, becomes fully effective on July 22 this year. It provides more convenient procedures than were previously available for determining how much pesticide may remain on a crop when it is marketed. Recognizing that sprays and dusts are necessary to assure a continuing supply of high quality foods, it is designed to permit the effective use of pesticides in the production of food without hazard to the consumer.

Generally food hazards arise from the chronic toxicity of a pesticide rather than its acute toxicity. This is so because many materials are applied to dormant trees or to growing crops well before harvest. Of those coming into contact with the edible portion, many are either volatile or are lost by decomposition and by weathering. As a result, if the pesticide has been used in accord with directions, only minute quantities remain on the harvested crop. Under the new Public Law 518 this amount cannot exceed the tolerance which has been established as a safe limit.

(*Continued on Page* 128)

theories and practices on AMMONIATION

by Elmer C. Perrine

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AMMONIA is the lowest cost nitrogen. Thus from the economic angle alone, it behooves management to use as much of this product as practical — whether it be ammonia contained in the ammoniating solutions or as anhydrous ammonia. In addition to the price advantage, many persons believe that much of the good condition of ordinary fertilizer is achieved through high rates of ammoniation, and that extreme rates are almost mandatory in granulation. Also the heat of the ammoniation reaction is desirable in more cases than in granulation alone. We are not unmindful of the possibility of reversion in the P_2O_5 and of some other disturbing features related to high as well as to low rates of ammoniation.

If anhydrous ammonia alone could supply all of the nitrogen required in all of our formulas, the problems would be greatly simplified. It so happens that the second lowest cost nitrogen is derived from chemicals that are logically in combination with anhydrous ammonia. This combination forms the very popular ammoniating solutions. The makers of these solutions are constantly trying to meet the demands of performance that are being put on their products.

One of the most significant developments in the fertilizer industry in recent years has been the doubling of the old long-time rate of 3 pounds of ammonia per unit of P_2O_5 in 20% superphosphate. As more suitable ammoniating media are developed and some of the shortcomings are circumvented, the demands focus more on getting a few more pounds of ammonia into the superphosphate. This is just about the number one problem; and it is through an understanding of the theories and practices of ammoniation that this problem can be solved.

Ammoniation can be effected a little more readily with nitrogen solutions than with anhydrous ammonia . . . this discussion, however, deals with ammonia regardless of its source. The principles remain the same although it is necessary to vary the techniques a little in handling anhydrous ammonia. "Superphosphate" in this article refers to a normal 20% product. The same principles apply to the ammoniation of triple superphosphate, but the practical limit of ammoniation seems to be about half that for the 20% material. It should be noted too that the presence of many large particles reduces the ammonia take-up seriously, as shown in a study on particle size by the USDA.

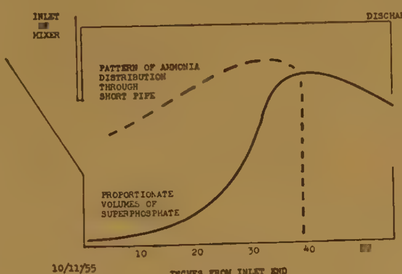
About the same amount of ammonia can be added to a given amount of superphosphate, whether the superphosphate is in a nitrogen-phosphorous base or in such dilute formula as the 3-12-12. It is necessary only to provide a little mixing of the dry ingredients prior to introducing the ammonia into complete goods.

Normal superphosphate has such a high affinity for ammonia that almost any scheme that brings the two materials into reasonable proximity for a short time will result in 2.5 to 3.0 pounds of ammonia being taken up per unit of P_2O_5. With 20% superphosphate the theoretical limit is 9.6 pounds of ammonia plus about one pound of each three pounds of free acid present. Until 6 or 7 years ago, ammoniating arrangements were such that in the initial steps, most of the ammonia was taken up by less than half of the superphosphate. Some operators were never converted to modern techniques, and an apalling number have gone back to the old methods because of their failure to understand the newer developments.

The reactions at the lower levels are almost instantaneous and permanent. Today, however, we are attempting to make all of the superphosphate do its share of the work.

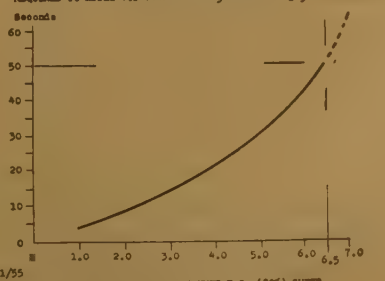
Superphosphate probably takes up ammonia beyond 3 pounds per unit of P_2O_5 more slowly than before this point is reached. The gas will react more slowly with dry materials than will the liquid from which this gas escaped. We certainly must provide means for reacting this gas when we go beyond 3 pound rates of ammoniation at the tons per hour rates that pay off. This requires intimate contact, combined with either continual or repeated exposure of the superphosphate to the gas. As the task of reacting the gas is the most serious of the ammoniating problems, it is advisable to generate the gas only as fast as it can be taken up in the reactions.

PATTERN OF DENSITY OF MATERIALS IN ROTARY MIXER



TOTAL TIME IN SECONDS

REQUIRED TO APPLY 6.5 POUNDS OF NH_3 PER UNIT P_2O_5 (20%) SUPER



POUNDS OF AMMONIA PER UNIT P_2O_5 (20%) SUPER

These production problems are almost the same with both nitrogen solutions and anhydrous ammonia. They differ only in degree and not nearly as much in degree as is generally supposed.

These principles are more easily understood when applied to the conventional rotary batch mixer. The TVA type of continuous ammoniator uses different means to implement the principles. But the principles will help in getting the very best performance regardless of the type of ammoniator used.

All of the finely screened materials should be in the mixer before ammoniation is started. It is usually best to use the full capacity of the mixer. This will assure better contact with the ammonia and provide for maximum "scrubbing" of the gas by the showering mass. We have found no improvement in ammonia take-up nor in condition of the goods when the superphosphate is ammoniated in the mixer prior to admitting the balance of the materials. Some operators attempt to ammoniate the mass collectively, or the superphosphate separately, as the materials are sliding into the mixer. How could an ammonia distributor pipe be drilled to successfully achieve this feat?

The distribution of the mass in the rotary mixer has probably become constant after one revolution of the mixer. You can watch a small glass mixer and see this. Most continuous ammoniators rightly provide for some mixing ahead of the ammoniator to conserve its capacity for the important function of getting the ammonia into the superphosphate.

It is possible to locate the holes in the ammonia distributor pipe with a pattern that will introduce the right amount of ammonia for the amount of superphosphate that exists along every inch of the length of the mixer. And it is extremely important to do this. In the conventional mixer this means a pipe that extends through the entire length of the mixer. In some cases, it is necessary to offset a portion of the end to clear the movements of the discharge door. In some mixers, it means cutting off some of the width of the extremely wide flights to allow clearance between the flights and the discharge door. Some mixers are so long that it is difficult to support the pipe.

All of these problems are being met, and quite easily in most mixers. But it would pay to throw away even a costly new mixer that can not be made to accomodate the higher ammoniation rates . . . for that is indeed a costly mixer. Were it not that stainless steel does the job perfectly well, it would be profitable to make a good ammonia distributor pipe even of gold or platinum for the savings in the cost of nitrogen can run over $200 per operating day.

Actually, this distributor pipe is a metering device or manifold whether it is so recognized or not. And it had better be a good one. It contends with requirements as exacting as many of the manifolds in the chemical industry. Both types should be given the same close attention that they deserve.

For years enough has been known about the requirements of a distributor pipe to justify making the next one of stainless steel. We admit that there is room for improvement. The holes of an ordinary steel pipe soon corrode, thus destroying any ability to correctly meter the ammonia to the desired points in the desired volume. So then you have to reduce the amount of low-cost nitrogen that can be used, buy a dozen gas masks, and start on the hunt for that nitrogen that the state chemist failed to find in your fertilizer.

The problems of gas are greatly reduced when the ammoniating medium is applied in its liquid state in such a manner that every particle of superhosphate can be contacted at least once by the liquid. It is quite conceivable that in batch rotary mixing the particles are returned several times for repeat baptisms of ammonia, thus effecting an accumulative, or multi-stage ammoniation. It does not require much imagination to believe that this is also happening in the TVA unit, and just as effectively.

Judged by the speed by which moderate rates of ammoniation are performed with good equipment, there is much evidence to indicate that as much as 4 pounds of ammonia can be taken up from the solution while it is still in solution. The duration of the act of ammoniation for these moderate rates need not exceed 25 or 30 seconds.

Atomizing sprays have been tried. If it were practical to retain the fogging effect that is so easily demonstrated outdoors, we would be ammoniating at much higher rates. But the very heavy showering curtains of fertilizer blanket any known atomizing spray. The effect is that of a very few holes in a pipe and those very poorly placed.

One continued slot for the length of the pipe with additional short slots to effect a good pattern was tried. This failed, probably because the very thin sheets of liquid lacked driving power for penetration. The ammonia was deposited in a thin layer on the surface of the thick curtains of material. If time were of no concern, this, as well as many other discarded methods, would suffice.

Much more superphosphate is contacted in a short time through the modern distributor pipe by its 12 to 30 powerful streams located strategically, each of which can penetrate the heavy loose curtains and disperse inside for yet more contact. "It delivers the milk along the street as called for by the concentration of milk drinkers along the street."

If no scale or rust can enter the system, the holes in the pipe may be 3/16 inch drilled in one row on one side of the pipe. This size of hole permits twice the number of points of contact that will result from ¼ inch holes. There is no justification for using ordinary steel in such a vital place as the distributor pipe. Where any ordinary steel exists elsewhere in the system, the holes in the pipe should be ¼ inch, even though the pipe itself be of stainless steel.

Even the most ardent supporter of the principles which have been outlined will concede that gas is a certainty at 5 pounds of ammonia per unit of P_2O_5 in 20% superphosphate and probably at a lower level. At the popular high rates of ammoniation and of plant production the problems of gas take on magnitude. No mixer is tight enough to hold the gas if provisions are not

(*Continued on Page* 133)

FERTILIZER
Views and News

By Vincent Sauchelli

Plant Nutrient Ratios

Recent correspondence from European friends discussed the trend in their respective countries concerning the current average ratios of plant nutrients consumed in commercial fertilizers. A comparison with ratios commonly employed in the United States is quite interesting. Here the general trend is toward a 1:1:1 ratio, if we average the grand total of all nutrients consumed as mixed fertilizers and materials. The general ratios during the past few years have been as follows, according to the N.P.F.K.:

1940 — 1.0:2.2:1.0
1950 — 1.0:2.0:1.1
1953 — 1.0:1.3:1.0
1954 — 1.0:1.3:1.0

The consumption of nitrogen is showing increases in all regions of our country. The national decrease in phosphate is due to less of it being used in mixtures relative to increases shown for nitrogen and potash. Some regions used increasing amounts of P_2O_5, but the general average is as indicated.

In Sweden the average among the three primary nutrients is currently 1.0:1.5:1.3, varying with soil types. For example in fertilizers used on clay soils it is 1:1.5:2, and on peat or muck soils, it is 1:2.9:4.

The increasing production of synthetic nitrogen in many countries is enabling farmers everywhere to apply larger amounts of this element to their cropland. This is all to the good. Soil scientists know from the Mitscherlich law of growth that the coefficient of phosphorus effectiveness is almost twice that of nitrogen in stimulating plant growth, and therefore it is necessary for the grower to use more nitrogen relative to phosphorus if optimal crop yields are to be achieved. For example, in Germany it is customary to use on cabbages per hectare, 300 kg. of nitrogen and 120 kg. of phosphoric acid (P_2O_5); and on sugar beets, 160 kg. N. and 80 kg. P_2O_5. The ratio of N:P_2O_5 is almost 2:1 and this conforms with the best information available as to what it should be.

In my March column consumption data for some European countries were given. Several have inquired as to how the U.S.A. figures compare with those for other countries. Because of the vast extent of our country and the great diversity of crops and soils, it is impossible to give a satisfactory average figure that means anything. Some states, New Jersey and Florida, for example, would show average figures comparable with those for the Netherlands; other states, having a high acreage of cropland, like Oregon, but low total consumption of fertilizers, would show a very low per-acre consumption even though on the acres actually fertilized the rate would be relatively high. Some averages have been computed and here they follow for what they may be worth: during the fiscal year 1953-54 most of the farmers in the 15 states from New Hampshire to Florida used an average of 171 lbs. of fertilizer per crop-acre, whereas Florida used an average of 1440 lbs. per harvested acre. Compare this with 2 lbs. per acre in South Dakota, 80 lbs. per acre in Wisconsin and 87 lbs. per acre in Illinois. The general average for the U.S.A. in this period was 119 lbs. of fertilizer per acre, the fertilizer having an average analysis of 5-11.6-10.3 which, translated into pounds of nutrients, was about 6 lbs. N, 14 lbs. P_2O_5 and 12 lbs. K_2O, totaling 31 lbs. of plant nutrients per acre.

Compare this with some European countries as given in this column in the March issue:

Netherlands: 177 lbs. per acre
Belgium: 166 " " "
Germany: 109 " " "
Denmark: 98 " " "

We see that American farmers generally have a long way to go before they can realize fully how efficiently chemical fertilizers can help them reduce their crop unit cost of production and thus put more net profit in their pockets.

Dollars for Nickels

Back in 1951 some progressive farm leaders from the Grange and the Farm Bureau in North Carolina conceived a plan to help the agriculture of that state which is unique in this country. Farmers who bought fertilizer and feed were to be asked to contribute through a self-imposed tax of 5 cents a ton on each of these two farm items to a research fund. This would be administered by the State College of Agriculture through its agency, The Agricultural Foundation, Inc., to develop more know-how for North Carolina agriculture. The plan was accepted by a large majority and the state legislature legalized it that same year. The law requires that the plan must be approved by two thirds of the farmers on a referendum vote every three years. The plan must be proving itself, for on October 15, 1954, it was again approved by a 19 to 1 margin, that is, by 95% of those voting.

Since the plan was started on January 1, 1952, it has produced $140,000 per year. An example of

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As a result of recent federal legislation, specific standards of safety have been established for the application of pesticides to food crops.

Object of this legislation, popularly known as the Miller Bill, is to safeguard the public health.

Under the Miller Bill, Pyrenone (technical *piperonyl butoxide* and *pyrethrins*), CPR dusts and sprays (combinations of *piperonyl cyclonene, pyrethrins* and *rotenone),* Pyretox, pyrethrum and rotenone are exempt from the requirements of a *tolerance* — when applied to growing crops. They may be used right up to the time of harvest.

With respect to the application of dust and spray protectants to stored grains, *piperonyl butoxide* has an approved tolerance of 20 p. p. m. . . . and *pyrethrins* a tolerance of 3 p. p. m. These two chemical agents are the active ingredients of the Pyrenone protectants. Yet the quantities specified for use in the package directions are less than the tolerances granted under the Miller Bill.

This season use Pyrenone and play safe. It protects both the crops — and the farmer's crop investment! For complete technical data, write the nearest office of Fairfield Chemical Division, Food Machinery and Chemical Corporation.

*Reg. U. S. Pat. Off., F. M. C.

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In Canada: Natural Products Corporation, Toronto and Montreal how the plan works: one research project developed a method of controlling June beetle grubs which cause an annual damage to pastures estimated at $1,750,000. At present the Foundation has 18 full-time research projects, four of which involve farm chemicals to control nematodes, insects, weeds and pesticide residues. The plan has demonstrated its capabilities to return dollars for nickels.

This is the sort of thing which should be encouraged in every state. Farmers who contribute their money to the support of research, in the planning of which they can directly participate, will have a greater appreciation of the worth of the research. Besides, their counsel to the research workers can be most helpful. Why do not more farm leaders and leaders in our agricultural chemicals industry get together to promote similar nickels-for-know-how plans in every state of our country?

Research Needed in Corn

J. E. Johnson of Champaign, Ill., an outstanding farm manager and leader in his community, forwarded me some keen observations on needed research in corn breeding. Last fall I spent a pleasant day with Mr. Johnson and his son Morris checking the condition of corn fields in which the Johnsons have an interest. We covered an area of about 200 square miles. One thing we observed created much interest and comment: on most of the ears the upper third or fourth had not developed kernels. It seemed that the silks in this position of the ear had not been receptive to the pollen. Was this due to a genetic characteristic of the new hybrids or an effect of the extremely hot weather and drouth conditions which prevailed during tassel and ear-forming time? No one had the answer. But it should arouse the interest of corn breeders.

Another observation made concerned the quality of the stalks. The breeders should give more attention to the height of the stalks and the placement of the ears. It is feared that in this as in other developments of agricultural products more is done for "eye-appeal" than, for example, to increase the largest number of ears of No. 2 grade of corn; big, bulky ears having too large a cob and high moisture content are not quality corn. "More pounds of quality corn per acre," should be the slogan to guide the corn breeder and farmer. Corn growers seem to be unduly impressed at picking time by the bulk in the wagon. They do not consider the part that cob size plays in the bulk of the picked corn ears; neither do they estimate the moisture content of both the kernels and the cob nor the protein content of the corn in their final measurements of the crop yield. In other words, as previously stated, the emphasis in too many cases is on eye-appeal rather than on true quality values.

Soil Testing

Are you sure you understand the purpose of soil testing? This is not asked to be facetious. Many farmers and fertilizer field men and agricultural workers seem to have an excessive faith in the analysis of soil. Soil scientists generally appreciate the limitations of this new tool in soil management. However, exaggerated claims are being made by the unscrupulous and also by many honest but misinformed. Perhaps it will not hurt the value of this guide to the cropping potential of a soil if we debunk some of these wild claims. Many farmers have been made to think that a soil test is used to find out, as John Falloon of the Missouri AES states it, "the 'deep secrets' and 'mysteries' hidden in the soil." "I am afraid," he continues, "that some have unintentionally represented tests as a 'magic wand' rather than the addition of another diagnostic tool to be used along with observations of plant symptoms and other information to arrive at soil treatments."

An agronomist considers soil productivity from two angles; namely, the physical characteristics of the soil and the fertility level or the content of available plant nutrients. These two factors influence the recommendations: a soil may have a high level of fertility but, if, for example, a hard impervious clay pan is present, or if drainage is poor, the crop yield will suffer. Man can modify the physical characteristics of crop land only slightly, but he can do much to increase soil fertility. Chemical fertilizers enable him to do this. The soil test is directed toward fertility and the analyst has to depend upon the farmer for additional information about the physical characteristics if he is to interpret the analysis with a good degree of precision. The normal soil test represents an inventory of the nutrient level in the surface 6 to 8 inches of soil or the equivalent of 1,000 tons of top soil per acre. The smallest field will contain many tons of top soil and to obtain a statistically true sample by the usual method and amount of soil is quite impossible: a ton rather than a pailful of soil would be needed. You see it is all an approximation. The developers of the soil test method had to make a number of assumptions in correlating the chemicals used as extractants with the soil plant nutrients extracted and those not-extractable, also called non-available. At best only about 70% accuracy, it is estimated, can be attributed to these assumptions.

Another factor which is interposed is the more common current method of placing fertilizers in bands instead of broadcasting them. This makes unrepresentative sampling of the soil even more liable to serious error, because it is possible that the fertilized strips of soil in a field may have a high content of carry-over fertilizers, and the soil between the bands may not. The field soil is, in other words, not homogeneous and the current method of sampling cannot possibly produce a representative soil sample. And a test is no better than the sample.

The soil test is more adapted to finding abnormalities. It may show which and where nutrient deficiencies in a field exist or similarly where sufficiencies exist. It may tell a great deal about balance, that is, the rela-

(*Continued on Page* 131)

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Results of 1955

FUNGICIDE TESTS

FOR the third consecutive year the American Phytopathological Society Temporary Advisory Committee on Collecting and Disseminating Data on New Fungicide Tests* has prepared a summary of results of recent fungicide, bacteriacide and nematocide trials. Experiments in 1955 were conducted by 70 plant pathologists or groups of plant pathologists working in 26 of the United States and four provinces of Canada.

Most of the information in this and previous reports consists of data obtained during one season in particular locations, and results should not be interpreted as being conclusive. Several compounds that give better disease control than recommended ones cannot be recommended for widespread use by growers until they have been more thoroughly tested.

Grateful acknowledgement is made to the co-operators who willingly made data available, to the staff of *Agricultural Chemicals* for its co-operation in publishing these reports, to the National Agricultural Chemicals Association for mailing reprints, and to the many commercial organizations that have contributed generously to the financial support of the project.

This report was prepared by D. A. Roberts, Plant Pathology Department, Cornell University, Ithaca, New York.

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33. Zaumeyer, W. J., and R. E. Webster

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39. Cetas, R. C.
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42. Massey, L. M.
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51. Graham, T. W.
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59. Wingard, S. A.

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62. Sprague, R.

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Wisconsin
64. Hoppe, P. E.
65. Perry, V. G.

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Nova Scotia
67. Hockey, J. F.

Ontario
68. Chamberlain, G. C.

Quebec
69. Lavallée, E., and J. Simard

Foliage Sprays and Dusts

Field Crops

Corn. Nabam plus zinc sulfate or maneb gave excellent control of Helminthosporium diseases of corn in Florida (18).* Results of one test are presented in Table 1.

---

*J. W. Heuberger, P. R. Miller, D. A. Roberts, R. H. Wellman, and L. G. Utter, chairman.

*Numbers in parentheses refer to listing of cooperators and locations of experiments.

Tobacco. Zineb (6.5% dust) is recommended for control of blue mold of cigar-wrapper tobacco seedlings in Florida (21). Zineb, maneb (3.5%), and streptomycin sulfate (1.0%) gave excellent control, but the antibiotic was slightly phytotoxic. When used at 0.5% concentration, streptomycin sulfate was not phytotoxic and gave "good" control of blue mold. In the Florida test (21), dusts were applied 3 times a week until 10 applications had been made. From 15 to 35 lb./A. were put on each time.

Results of other tests of materials for controlling blue mold and wildfire are presented in the Antibiotics section of this report.

Fruit and Nuts

Fungicides tested for control of diseases of these plants are listed in Table 2.

Apples. SCAB DISEASE. When applied at 8x concentrations, good control of scab on fruit was obtained in New York (38) with any of the following fungicides: Vancides A and M, ferbam, Thylate, Captan 50-W, and glyodin-ferric sulfate-lead arsenate (Table 5). Somewhat poorer control of fruit scab was obtained with sulfur, where Magnetic 70 was followed by applications of dry wettable. A high percentage of russeted fruit occurred in blocks sprayed first with glyodin and then with glyodin, ferric sulfate, and lead arsenate.

In a test near Poughkeepsie, N. Y. (43), Captan 50-W controlled scab satisfactorily and trees sprayed with it yielded better than did those sprayed with Fermate or Crag 341 or with a Crag 341-Puratized Agricultural spray mixture followed by Crag 341 alone. Good control of scab was obtained in each plot.

TABLE 1

Results of spray tests for control of Helminthosporium diseases of corn in Florida (18).[a]

Fungicide	Amt./100 gal.	Disease Severity[b] *H. maydis*	*H. turcicum*
None	—	7.7	—
nabam + zinc sulfate[c]	2 gal.	2.0	1.3
maneb[c]	1.5 lb.	3.2	1.1
ferbam[c]	2.0 lb.	3.0	2.8
Vancide Z-65[c]	2.0 lb.	3.0	2.8
ziram[c]	2.0 lb.	3.2	2.8
Carbide & Carbon 7443[c]	2.0 lb.	3.7	2.3
zineb[c]	2.0 lb.	3.7	2.0
Vancide MX 427	2.0 lb.	4.0	3.1
XSF3 (Woodhuysen silver)	1 qt.	5.0	4.8
captan	3.0 lb.	6.0	3.5
dichlone	0.5 lb.	8.2	—
PCNB	2.0 lb.	8.0	—

[a] Sprays applied 18 times at bi-weekly intervals.
[b] 0 = no disease; 11 = complete defoliation.
[c] Recommended for use by growers.

In Pennsylvania (50), where fungicides were applied at 3x concentrations to Stayman and McIntosh apples, excellent scab control along with good fruit finish

TABLE 2

Fungicides tested for the control of fruit and nut tree diseases[a]

- Bordeaux mixture
- captan
  - Captan 50-W
  - Orthocide 50-W
- Chlorosulfane
- C. I. L. Mercurial
- Copper A compound
- copper carbamate
- Coromerc
- Corona CM220
- Coro SDD plus iron sulfate
- Coro SDD plus zinc sulfate
- Crag EM
- Crag GR
- Crag LO
- Dow Dormant
- Dowicide G
- ferbam
  - Fermate
- Fixed Copper Compound
- Fundal
- Fungicide 8
- Geigy 17962
- GLF Experimental Mercury
- Thylate
- Tribasic copper sulfate
- Vancide A
- Vancide AS
- Vancide M
- Vancide MS
- glyodin
  - Crag 341
- Hercules Powder AC2485
- Karathane
- lime-sulfur
- Magnetic 70 sulfur
- maneb
  - Manzate
- Merbam
- Mesulfane
- nabam
  - Dithane D-14
- Norsulfane
- Ortho Cop 53
- Orthorix
- phenylmercury chloride
- Phix
- Phygon XL
- Polysulfide compound
- Puratized Agricultural Spray
- Robertson's fungicide
- Sinox General
- Thioneb
- Thiram
- wettable sulfur
- Zerlate
- zineb
  - Dithane Z-78

[a] Fungicides are listed in this table to serve as a guide for those who wish to learn quickly whether or not a particular fungicide was used in tests for disease control of fruit and nut crops. Chemical names of active ingredients of many of these fungicides are given in: McCallan et al (Phytopathology 45:295-302. 1955.)

TABLE 3

Fruit scab and fruit russet of McIntosh and Stayman apples in Pennsylvania (50) sprayed with fungicides at 3x concentration where 4 gal. of liquid were applied to each tree in each of 10 sprays

	conc./100 gal.		Fruit scab at harvest		Fruit russet	
Fungicide	5 appl.	5 cover sprays	Stayman	McIntosh	Stayman	McIntosh
			weighted	average	%	%
Sulfur[a]	18 lb.	18 lb.	3.3	3.4	17.8	24.6[b]
(glyodin plus	1.75;	—)				
(PAS	0.75 qt.	)	2.8	3.6	15.0	26.6[b]
(		)				
(glyodin	—	3.75 qt.)				
(captan plus	3 lb.	—)				
(PAS	0.75 qt.	)	2.8	0.7	15.2	15.4
(		)				
(captan	—	6 lb.)				
Thylate	4.5 lb.	4.5 lb.	1.5	6.6	16.8	24.4[b]
(captan plus	1.5;0.75 lb.	—)				
(Phygon		)	0.0	1.4	13.4	21.2[b]
(captan	—	6 lb.)				
(glyodin plus	1.75 qt.;	—)				
(Phix	6 oz.	)				
(		)	3.2	0.8	20.0	23.2[b]
(glyodin	—	3.75 qt.)				
captan	6 lb.	6 lb.	0.0	0.3	17.6	19.0
captan plus zineb	3;2.25 lb.	3;2.25 lb.	0.0	0.7	13.4	24.8[b]
glyodin	3.75 qt.	3.75 qt.	6.3	1.7	29.0	21.8[b]
None	—	—	74.2[c]	68.6[c]	11.7	9.2

[a] Magnetic 70 paste.
[b] Significantly different from check when P = 0.05.
[c] Significantly different from other treatments when P = 0.05.

TABLE 4

Performance of recommended fungicides tested at 2x concentration for apple scab control in New York (43).

	conc./100 gal.		Fruit scab			Rating of
Fungicide	4 appl.	7 appl.	Early	Late	Yield	fungicide
	2x	2x	%	%	Boxes/tree	1 = best
Captan 50-W	2.0 lb.	1.5 lb.	2	15	41	1
Fermate	1.5 lb.	1.0	4	0	32	2
Crag 341	2.0 pt.	1.5 pt.	4	16	33	3
(PAS plus Crag 341	0.5 and	—)	1	19	30	4
(	1.0 pt.	)				
(		)				
(Crag 341	—	1.5 pt.)				

HOW UNION BAG BUILDS MORE BUSINESS FOR THE FERTILIZER INDUSTRY

"I insist on fertilizer in Multiwall bags," says world champion corn grower

Willard C. Kirk, farmer,
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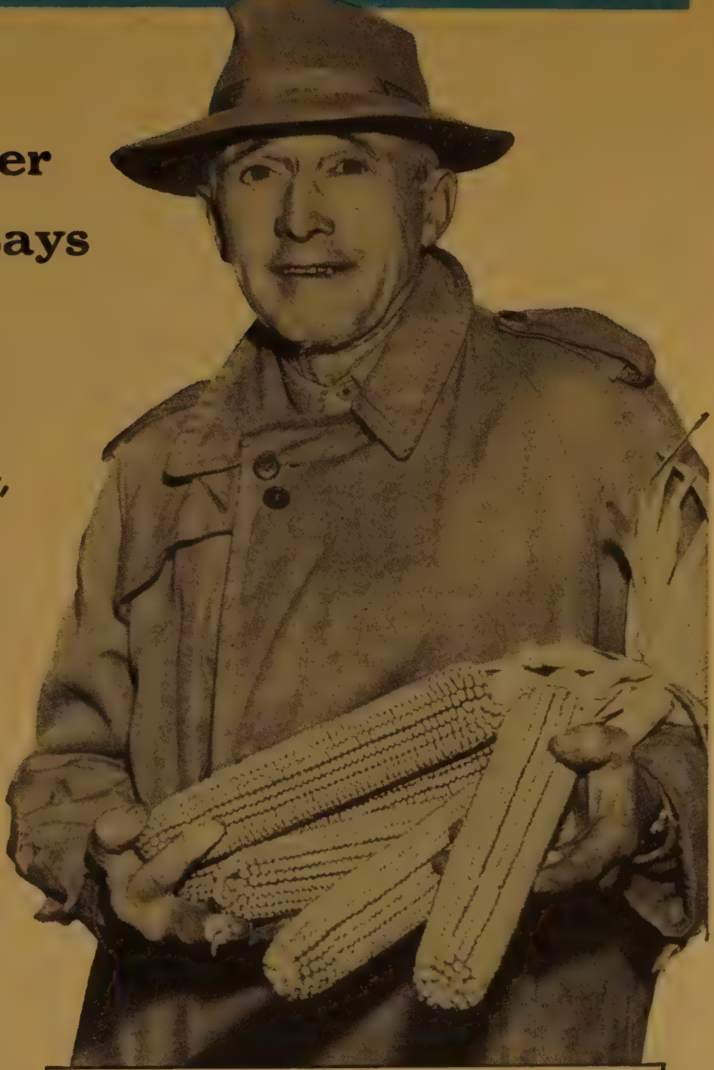

"Science rules on my farm," says Mr. Kirk, winner of many "ten ears" awards and trophies. "I rotate strictly so as not to rob my soil—soybeans and oats, one year each; pasture, two years; then corn, one year. I use lots of fertilizer, and prefer it packed in 80-lb. Multiwalls. I find Multiwalls easy to handle and store, and to open and empty completely. Also, fertilizer does not sift out of these paper bags."

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Are you completely posted on all the recent advances in multiwall packaging of fertilizer? We will be glad to show you some of the new Union sacks the industry is now using so successfully.

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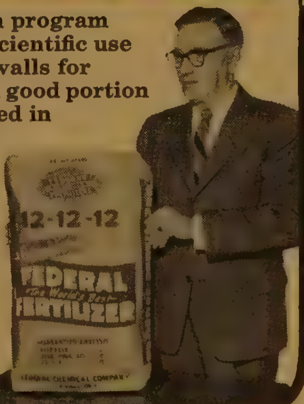

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TABLE 5

Apple scab control in New York (38) through the use of recommended sprays at 8x concentration applied with a speed sprayer.

Fungicide	conc./100 gal. 5 appl.	conc./100 gal. 5 appl.	Fruit scab	Fruit russet
	8x	8x	%	%
Thylate	1.5 lb.	1 lb.	0.8	1.1
ferbam	1.5 lb.	1 lb.	0.4	0.9
Vancide[a]	1.5 lb.	1 lb.	0.2	1.2
Captan 50-W[b]	1.5 lb.	1 lb.	1.3	1.2
Sulfur[c]	6.0 lb.	5 lb.	4.2	1.3
glyodin[d]	1.0 qt.	0.75 qt.	1.2	36.7

[a] Vancide A used in first 8 applications; Vancide M used in last 2 applications.

[b] When used on Baldwin or Delicious varieties, recommended for sprays made 6 or more weeks after petal fall.

[c] Magnetic 70 used in 3 applications, May 6-16; Dry wettable sulfur used in 5 applications, May 24-June 20. Sulfur recommended only for pre-bloom and petal fall sprays.

[d] Ferric sulfate and lead arsenate used with glyodin in 4 sprays, May 24-June 20. Ferric sulfate should not be used until 6 or more weeks after petal fall.

TABLE 6

Apple scab, fruit set, and fruit russet of McIntosh apples in Pennsylvania (50) sprayed 4 times with mercury-containing fungicides and 6 times with captan and malathion cover sprays.

Mercury-containing fungicide	conc./100 gal.	Fruit scab at harbest	Fruit set[a]	Fruit russet
		%	%	av.
PAS	0.5 pt.	9.6	18.6	6
Coromerc	0.25 lb.	10.6	16.4	10
Phix	0.125 lb.	8.0	14.4	12
Merbam	0.25 lb.	11.1	12.2	9
GLF Exptl.	0.083 pt.	5.5	14.5	10
Phenyl mercury chloride	2.0 lb.	13.0	19.0	4
None[b]	—	87.2[c]	11.6	8

[a] Number of blossom clusters multiplied by 5 and divided by number of fruit set.

[b] All plots received 6 cover sprays.

[c] Significantly different from other treatments when $P = 0.05$.

TABLE 7

Ratings of fungicides tested for apple scab control in Virginia (57).

Fungicide	conc./100 gal.	Disease control	Phytotoxicity	Recommended?
		1 = best	1 = least	
captan	2 lb.	1	1	yes
glyodin plus PMA	24 oz.; 3 oz.	1	1	yes
Sulfur-Ferbam	5 lb.; 1 lb.	1	4	yes
thiram	1.5 lb.	3	1	not yet
glyodin	24 oz.	2	3	conditionally
Vancide A	1.5 lb.	3	2	not yet
Fundal	2 lb.	5	1	no
Fungicide 8	8 oz.	1	2	no
Thioneb	12 oz.	4	1	no
Merbam	not stated	2	1	no

TABLE 8

Performance of fungicides tested for control of powdery mildew of apple in Washington (62).

Fungicide[a]	conc./100 gal.	Ratings Disease control	Ratings Phyto-toxicity
Karathane[b]	1 lb.	good	none[c]
Liquid lime-sulfur[b]	2.5 lb.[d]	good	none[e]
Polysulfide compound[b]	4 lb.	good	none[e]
Orthorix[b]	2 qt.	good	none[e]
Karathane plus glyodin	1 lb.; 0.5 pt.	good	none[c]
Hercules Powdery AC2485	2.5 lb.	fair	slight
Thylate	1.5 lb.	poor	none
Geigy 17962	0.5 to 2 lb.	excellent	culls or drops
Copper carbamate	1.5 lb.	poor	slight

[a] Listed in decreasing order of experimenter's preference. Applied 4 times from pre-pink stage to 2nd cover.

[b] Recommended for grower use.

[c] Phytotoxic on leaves when temperature is 90°F. or above.

[d] 3.0 lb. in pre-pink application.

[e] Culls on Jonathon variety.

occurred in plots receiving captan all season or captan and P.A.S. followed by captan cover sprays (Table 3). Other organic fungicides controlled scab better than did sulfur, but, along with sulfur, resulted in relatively high percentages of russeted fruit. Fruit of the Stayman variety generally were less severely russeted than were those of the McIntosh variety. One of 6 mercury-containing fungicides effectively controlled scab of McIntosh apples when followed with 6 cover sprays consisting of captan and malathion (Table 6).

Spray schedules using either captan or glyodin plus PMA all season, or those using first sulfur then ferbam are recommended in Virginia (57). Vancide A, thiram, and Experimental Fungicide 8 showed promise of giving good results (Table 7).

In a trial in Nova Scotia (67) apple scab was controlled by any of five fungicides tested, but the best over-all results were obtained with captan or glyodin (Table 9). In this test, ferbam gave poorer control of apple scab than did sulfur.

On McIntosh apples in Ontario (68), sprays containing captan gave excellent control of scab and were preferred by the experimenter over the other materials tested (Table 14). Good results were obtained with Phygon XL followed by Dithane Z-78, Vancides A and M, C.I.L. Mercurial followed by Thylate, and Phix followed by Thylate.

POWDERY MILDEW. Magnetic 70 sulfur, Karathane, and captan were tested for control of powdery mildew of apple in Virginia (57). Sulfur and Karathane were practically equal in performance and were more effective than was captan, but neither sulfur nor Karathane gave complete control. Karathane, liquid lime sulfur, Polysulfide compound, and Orthorix are recommended for grower use in the control of powdery mildew in Washington (62). Results of one test are presented in Table 8.

MISCELLANEOUS DISEASES. Thiram at 2 or 2.5 lb./100 gal. satisfactorily protected Golden Delicious apples from blotch in Virginia (57), and Dithane Z-78, Thylate, and Orthocide gave good control of this disease in Oklahoma (Table 10). In Delaware (16) sooty blotch and 3 other diseases (*Botryosphaeria ribis* rot, black rot, and fly speck) were controlled best by a captan and zineb combination or by zineb (Table 11). Neither captan alone nor Thylate was effective. In Virginia (57), however, captan alone gave good control of sooty blotch, fly speck and "X" spot, and is recommended, along with ferbam and a captan-zineb combination (Table 12).

Table 13 includes a summary of recent results obtained in fungicide trials on Rome apples in Virginia (57). Good control of four diseases and a minimum of fruit russet occurred in plots receiving sulfur followed by ferbam, glyodin-phenylmercury combination, captan, or Thiram.

TABLE 9

Ratings of recommended fungicides tested in Nova Scotia (67) for apple scab control.

Fungicide[a]	conc./100 gal.	Fruit scab	Yield rating	Experimenter's preference
		%	1 = best	1 = best
captan	2 lb.	0.5	1	1
glyodin	1.5 qt.	1.0	2	2
PMA—ferbam	0.5 pt.; 2 lb.	0.9	4	3
Sulfur (Mag. 70)	9 lb. Then 6 lb.	0.8	3	4
ferbam	2 lb.	2.5	5	5

[a] Seven applications, May 6-July 13.

TABLE 10

Performance of 3 fungicides applied 5 times at 2-week intervals for control of blotch of Golden Delicious apples in Oklahoma (47).

Fungicide	conc./100 gal.	Percentage healthy fruit	phytotoxicity
Dithane Z-78	1.5 lb.	97	none
Thylate	1.5 lb.	95	none
Orthocide[a]	2.0 lb.	83	none
none		54	—

[a] Recommended for grower use.

TABLE 11

Performance of fungicides tested in Delaware (16) for control of 5 apple diseases.

Fungicide[a]	conc./100 gal.	Disease control blotch	 Four diseases[b]
		percentage fruit infection	rating
captan plus zineb	1 lb.; 1 lb.[c]	9	2
captan and zineb[d]	2 lb.; 1.5 lb.	7	3
zineb	2 lb.; 1.5 lb.[e]	6	1
captan	2 lb.; 1.5 lb.[e]	34	4
Thylate	1.5 lb.; 1 lb.[e]	34	5
none	—	55	—

[a] Listed in decreasing order of experimenters' preference. Eight gal. applied to each tree each time.

[b] Rating of fungicides based on control of sooty blotch, fly speck, black rot, and *Botryosphaera ribis* rot. Fungicides applied from 4th through 8th cover sprays.

[c] Concentrations reduced to 0.75 lb./100 gal. starting with 4th cover spray.

[d] Alternately.

[e] Fourth through 7th cover sprays.

TABLE 12

Rating of fungicides used in Virginia for control of sooty blotch, fly speck and "X" spot (57).

Fungicide	conc./100 gal.	Disease control ratings Sooty blotch fly speck	 X spot
		1 = best	
captan	2 lb.	1[a]	1[a]
captan and zineb	1 lb., 1 lb.	1[a]	1[a]
ferbam	1.5 lb.	1[a,b]	1[a]
Thiram	1.5 lb.	2[c]	2[c]
glyodin	24 oz.	4[d]	3
Vancide M	1.5 lb.	4[b,c]	2[c]
Fundal	2 lb.	5	3
Thioneb	12 oz.	3	2
Mesulfane	2 lb.	1	2
Chlorosulfane	2 lb.	2	2

[a] Recommended for grower use.

[b] Used only in the 7 cover sprays. Other fungicides used in these and in 2 pre-bloom sprays and 1 calyx pray.

[c] Not to be recommended cntil tested further.

[d] Recommended on a limited scale for late sprays.

TABLE 13

Percentage disease occurrence on Rome apples sprayed on a commercial schedule in Virginia (57).

Fungicide	Percentage disease Leaf scab	 Fruit scab	 Sooty blotch	 Fly speck	 X spot	Percentage Russet	 Large lenticels
captan[a]	3.5	1.6	0.0	0.0	0.0	2.4	0.0
glyodin-phenylmercury[a]	3.3	1.2	0.0	0.0	0.0	1.2	0.0
sulfur-ferbam[a]	2.7	1.6	0.0	0.0	0.0	1.2	7.6
Thiram (1 lb./100 gal.)	5.7	13.6	0.8	2.0	0.4	0.8	0.0
Thiram (1.5 lb.)	5.1	8.8	2.0	3.6	0.8	2.8	0.4
Thiram (2.0 lb.)	3.7	5.6	3.2	2.0	4.0	0.4	0.0
Thiram (2.5 lb.)	3.4	7.2	2.4	1.2	3.6	0.8	0.0
Crag LO[b]	1.6	5.2	12.8	5.6	34.0	5.2	0.0
Crag EM[b]	0.9	2.4	5.2	2.8	19.6	6.4	0.4
Crag GR[b]	1.3	2.8	13.6	3.2	8.4	4.8	0.0
Vancide A, then M	4.7	7.2	10.4	0.8	0.8	6.4	0.0
Vancide AS, then MS	2.5	2.4	2.8	0.0	1.2	8.0	0.0
Fundal	16.9	20.8	25.6	22.0	32.0	0.4	0.0
Fungicide 8, then ferbam	1.1	2.8	0.0	0.0	0.0	0.8	6.4
Thioneb[b]	15.9	11.6	7.6	0.0	0.8	0.0	0.0
merbam, then ferbam	4.2	2.8	1.6	0.0	0.4	0.8	0.8
Mesulfane	1.5	4.8	0.0	0.0	0.0	2.0	0.0
Chlorsulfane	3.9	4.8	0.4	0.8	0.4	0.0	0.0
Norsulfane	3.0	2.4	2.0	0.0	2.0	6.4	0.0
glyodin-malathion —Karathane	4.0	0.8	9.2	4.8	32.4	20.0	0.4
none	56.1	36.0	100.0	62.0	36.0	—	—
none	49.7	74.0	100.0	56.0	32.0	—	—
none	100.0	98.0	100.0	92.0	34.0	—	—

[a] Standard.

[b] All season.

Peaches. PEACH LEAF CURL. One fall application of Zerlate (3 lb./100 gal.), with or without Peerless FS-55 adhesive, or Fermate (3 lb./100 gal.) gave best control of peach leaf curl in California (4). Poorest results were obtained with Manzate (3 lb.). The following fungicides gave better control than did Manzate, but were not as effective as either Zerlate or Fermate: Dithane D-14 (plus either Peerless or Ortho adhesive), Captan (with or without Ortho adhesive), or Bordeaux mixture (10-10-100).

POWDERY MILDEW of peach in California (12) was controlled by 3 applications of liquid lime sulfur (1 gal./100 gal.), or by 1 application of liquid lime sulfur (0.75 gal.) plus Flotox wettable sulfur (5 lb.) followed by 2 of wettable sulfur, or by Karathane (1 lb.). Karathane was phytotoxic. Liquid lime sulfur or the lime-sulfur-wettable sulfur treatments are recommended for grower use.

Grapes. In one test in California (6) Emperor and Tokay grapes were dusted four times at the rate of 20 lb./A. with a material consisting of 50% captan and 10% sulfur. Significantly less rot had developed after four months of storage in treated lots than in non-treated ones, provided that harvest had occurred after the first rainfall of the season. This dusting treatment is not yet recommended for grower use.

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TABLE 14

Apple scab control in McIntosh orchard in Ontario (68) sprayed 7 times, including 3 cover sprays.

Fungicide	conc./100 gal.	Fruit scab	Experimenter's preference
		%	1 = best
Phygon XL; Dithane Z-78[a]	0.5 lb.; 2 lb.	4.1	4
Phygon XL;[b] Dithane Z-78	0.5 lb.; 2 lb.	0.8	2
Colsul sulfur	10 lb.; 8 lb.[a]	22.5	6
captan (50%)	2 lb.	0.6	1
captan (90%)	1 lb.	0.4	1
Crag	1.5 qt.; 1.5 pt.[a]	4.1	5
Crag	1 qt.	6.7	5
Dithane Z-78	2 lb.	1.8	3
Thioneb	2 lb.	1.9	3
Vancide[c]	2 lb.	0.5	2
C.I.L. Mercurial; Thylate[a]	0.5 lb.; 2 lb.	1.1	2
Phix mercurial; Thylate[a]	not stated	0.4	2
None	—	98.7	—

[a] Cover sprays.
[b] Eradicant spray.
[c] Vancide M used in cover sprays; Vancide A used in earlier sprays.

In a test in Michigan, concord grapes were sprayed five times for black rot control. Sprays were applied at 600 p.s.i. pressure and at the rate of 150 gal./A. when shoots were 4-6 in. long, at "pre-bloom" and "post-bloom" stages, 10 days later, and at the "berry touch" stage. Any of five fungicides tested gave good control (Table 16).

Strawberries. Seven applications of fungicides, beginning with one "delayed dormant spray" were made on Robinson strawberries in Michigan for control of gray mold. Best control was obtained with captan, or Coro SDD plus zinc sulfate, or Dithane Z-78, or with Zerlate (Table 15).

Fungicides containing captan (4 lb. /100 gal.) are recommended for control of fruit rots of Pocahontas and Blakemore strawberries in Virginia (58). In a test where fungicides were applied five times at approximately weekly intervals after April 5, captan fungicides were more effective than any of the following: Tennam (2 qt./100 gal.), zineb (4 lb., and Agrimycin (100 ppm).

Black Raspberries. In Michigan (35) Captan 50-W is recommended for anthracnose control, but somewhat more effective control was obtained with Coro SDD plus zinc sulfate and with Zerlate in 1 test (Table 17). Sprays were applied as a delayed-dormant eradicant and as two protectants, one when shoots were 6-8 in. long and one after blooming.

Pecans. Zerlate in five summer sprays is currently recommended for grower use in controlling pecan scab in Oklahoma (46). Excellent results were obtained when one of three eradicant spray materials was followed by five summer protective applications of Zerlate (Table 18).

Almonds. BROWN ROT BLOSSOM BLIGHT was controlled with any one of six fungicides applied at 400 p.s.i. at "10-40% blossom" stage (5). Fungicides tested were Zerlate (2 lb./100 gal.), Orthocide 50W (2 lb.), Zim plus Dithane D-14 (1 lb. plus 0.5 gal.), Manzate (2 lb.), Phygon XL (0.75 lb.), and Bordeaux mixture (10-10-100).

SCAB was best controlled by Orthocide 50W, Phygon XL, Zerlate, and Bordeaux mixture (5). Applications were made at the "popcorn" stage, one week after petal fall, and five weeks after petal fall. There was some phytoxicity with Bordeaux mixture when used at strengths of 10-10-100, 5-5-100, and 4-4-100, respectively for the three sprays. Wettable sulfur (6 lb.) gave some control, and ranked better than Karathane at 1 lb./100 gal. Liquid lime-sulfur or Tag, applied only at the "popcorn" stage, did not give satisfactory control.

(*Part 2 next month*)

TABLE 15

Control of gray mold of Robinson strawberries in Michigan (35).

Fungicide[a]	conc./100 gal.	Percentage disease control
Captan 50-W[b]	2 lb.	78.5
Orthocide 50-W[b]	2 lb.	76.5
Coro SDD plus zinc sulfate	1 qt.-1 lb.	74.5
Dithane Z-78[b]	1.5 lb.	65.0
Zerlate	2 lb.	55.0
Coro SDD plus iron sulfate	1.5 pt.-0.5 lb.	42.0
ferbam	1.5 lb.	31.0
Manzate	2 lb.	23.5
Bordeaux mixture[c]	6.8	19.5
Fixed Copper (53%)[b,c]	3-6	13.0
Phygon plus ferbam[c]	0.25 lb.-0.75 lb.	9.5
none	—	5.5

[a] Listed in decreasing order of experimenters' preference.
[b] Recommended for grower use.
[c] Some phytotoxicity.

TABLE 16

Performance of fungicides tested for control of black rot Michigan (36).

Fungicide	conc./100 gal.	Percentage healthy clusters	Yield
			lb./A.
Coro SDD plus iron sulfate	1.5 pt.-0.5 lb.	98.4	—
ferbam[a]	1.5 lb.	98.1	7961
Dithane Z-78[a]	1.5 lb.	97.8	8113
Captan 50-W	2 lb.	93.0	8083
Manzate	2 lb.	96.2	—

[a] Recommended for grower use.

TABLE 17

Fungicidal control of anthracnose of cumberland black raspberries in Michigan (35).

Fungicide[a]	conc./100 gal.	Average no. lesions/cane
Coro SDD plus zinc sulfate	1 qt.-lb.	3.72
Zerlate	2 lb.	4.30
Captan 50-W[b]	2 lb.	5.88
Coro SDD plus iron sulfate	1.5 pt.-0.5 lb.	10.24
ferbam plus Phygon	0.75 lb.-0.25 lb.	14.28
ferbam[b]	1.5 lb.	16.02
none	—	56.30

[a] Listed in decreasing order of experimenters' preference.
[b] Recommended for grower use.

TABLE 18

Performance of fungicides tested for pecan scab control in Oklahoma (46).

Fungicide	conc./100 gal.	Average no. lesions/shuck
PAS, then Zerlate[a]	5 pt.-2 lb.	0.9
Dowicide G, then Zerlate[a]	4.5 lb.-2 lb.	0.6
Corona CM220, then Zerlate[a]	3 lb.-2 lb.	0.3
Corona CM[b]	3 lb.	5.9
Zerlate[c,d]	2 lb.	2.5
none	—	88.7

[a] Dormant sprays applied to trees and to ground. Five summer protective sprays.
[b] No summer sprays.
[c] No dormant sprays.
[d] Currently recommended for grower use.

WASHINGTON
Report

by
Donald G. Lerch
Cornwell, Inc., Washington, D. C.
(Agricultural Chemicals Washington Correspondent)

THE famed Washington cherry-blossoms, currently luring thousands of visitors to the capital from all over the United States, are just one of Washington's many attractions. The Agricultural Research Center at Beltsville, Maryland, is an equally important attraction—not for as many visitors in total numbers but certainly in respect to the promise of good things for all of us in the future.

Last year, more than 11,000 people visited the Research Center. The visitor list shows that an average of 11 scientists from foreign countries called at the Center each working day during the year. The record of total visitors for any single month was made this past November when 1,899 people called at the Center.

Washington is in the midst of an organized effort by the Chamber of Commerce as well as various government agencies to build the area as the research center of the world. Certainly every agricultural chemical manufacturer is well aware of the influence Washington has on research work throughout the nation. Carrying out this research theme, here are a few of the recent decisions determining the direction research will take in several fields important to your industry.

The Department of Agriculture's Farm and Home Equipment and Structures Advisory Committee has recommended that the Department do more research on machines for applying farm chemicals, including pesticides, fertilizers, and weed control chemicals.

The Feed and Forage Research and Marketing Advisory Committee has just recommended that the Department expand its forage-crop breeding and insect-control research. Among the important lines of work cited by the Committee is the launching of immediate efforts toward control of the new highly destructive spotted alfalfa aphid and other insects of forage crops and stored grain. The Committee also asked for expanded research on control of weeds and brush on pastures and range lands in all sections of the United States.

Also under review is the status of the Khapra Beetle control program. Latest reports show that the insect has been eradicated by fumigation from about two-thirds of the grain-storage space found infested. That is sixty million out of 90 million cubic feet. Fumigation of infested grain storage buildings was first started about a year ago. The Khapra Beetle was first found in this country in 1953 in California, Arizona, and New Mexico at 345 locations of which 158 have already been fumigated.

Still another research project of interest to the agricultural chemicals industry is the Department's new search for foreign insects with weed-killing power as a new approach to wiping out halogenton, a fast-spreading poisonous range weed. Entomologist G. B. Vogt of the U.S. Department of Agriculture's Research Service is leaving this spring for the Mediterranean area, North Africa, and the near East in an attempt to discover and bring back to the U.S. insect enemies of noxious weeds, including halogenton.

At the present time halogenton can be controlled through the use of herbicides which appear to be economically advantageous when used primarily for spot treatments. However, since the weed covers large areas of range land which does not appear to justify heavy expenditure, this new search by the Department is being looked upon hopefully by cattle and sheep men.

When chemical control of halogenton is used, scientists recommend treating the plant with a low-volatile ester of 2,4-D.

* * *

Our government, usually concerned with expenditures in the billions, now has a problem of how to define zero. The zero refers to residue tolerances established by the Food and Drug Administration under the Miller Amendment. Recent actions by the Food and Drug Administration have apparently caused some pesticide producers to ponder the question of whether it may be better "to be or not to be."

You can be damned if you do and damned if you don't have a tolerance of zero. A zero tolerance may mean that a chemical is so toxic or has such alarming deleterious effects on health that it just cannot be permitted in any measurable amount on agricultural commodities in accordance with the Miller Amendment. This would then be known in popular terms as a very dangerous chemical.

On the other hand, an agricultural chemical may have such properties that when used in accordance with directions there should be no measurable residue on the agricultural crops at the time of harvest. Since the Food and Drug Administration's policy is not to permit any more residue on an agricultural crop than is absolutely necessary to perform a useful function—and even then only such residues as are not harmful — under such cases a zero tolerance can be a recommendation. It can mean that the product per-forms so efficiently that when used in accordance with approved practice the material should simply dissipate between time of application and the normal time of harvest, leaving no detectable residue.

While the problem of what is meant by zero may not be difficult for lawyers or real students of the Miller Amendment, it is causing some head scratching at agricultural colleges and experiment stations where spray schedules are being released to growers. Manufacturers who do have a tolerance of some kind, even zero, are in effect "cleared" by the Food and Drug Administration. At least they have "been to court" and a decision rendered. Chemicals which are not on the list, but which, under certain circumstances, are okay to use, could be somewhat suspect. It would certainly seem to indicate that companies in that position might be called upon by colleges to give supporting data as to why their products should be considered safe for use as directed.

A recent decision of the Food and Drug Administration is perhaps historic because it does set a zero tolerance. A zero tolerance has been set for endrin as follows: "Data in the petition does not show residues of endrin remain at harvest in or on: cabbage—cottonseed—cucumbers—eggplants—peppers—Irish potatoes—sugar beets including tops—summer squash and tomatoes when endrin is applied to crops in accordance with directions proposed in the petition. A tolerance greater than zero is not required for these uses."

It's interesting to note that the only materials thus far placed on what Food and Drug terms under the law as a safe list are sulfur, lime, and lime-sulfur.

* * *

The importance of public relations in agriculture is stressed in one of a series of four special radio features produced by Louis H. Wilson, Director of Information, National Plant Food Institute. Mr. Wilson, recently elected vice president of the Agricultural Relations Council and well known throughout the country for his constructive contributions to the field of agricultural public relations, selected the speakers and subjects for the recording: Earl L. Butz, Assistant Secretary of Agriculture, U.S. Department of Agriculture, "Public Relations for Farmers"; Robert Howey, President, National Vocational Agricultural Teachers' Association, Inc., "Beating the Price-Cost Squeeze"; Donald A. Williams, Administrator, Soil Conservation Service, U.S. Department of Agriculture, "Know Your Soil for Thrifty Farming"; and Dr. A. H. Moseman, Director of Group Research, Agricultural Research Service, U.S. Department of Agriculture, "Growing Better Crops."

These features are released on a request basis only, to approximately 1,000 radio stations from coast to coast. With the farm population becoming a smaller and smaller percentage of the total, Mr. Wilson believes that farmers and elected spokesmen of agricultural groups can profitably sharpen the basic public relations tools and put them to use in order to develop a broader public appreciation of the progressive and efficient strides made by farmers.

* * *

Two notable safety developments by the fertilizer and pesticide industries in cooperation with the National Safety Council are in operation. The National Plant Food Institute announces that prizes of $500 will be awarded in a nationwide "Picture of Safety Contest," to end June 30 and designed to "uncover good ideas which are already in practice, which have improved safety in fertilizer plants." The contest is sponsored by the Fertilizer Section of the National Safety Council and is open to any employee of the fertilizer industry. Entries are to be mailed to J. C. Kato, Fertilizer Section, National Safety Council, 425 North Michigan Avenue, Chicago 11, Illinois. No entry blank is required.

The National Agricultural Chemicals Association cooperated with the National Safety Council in the production of a flyer captioned "For Safe Use and Handling of Agricultural Chemicals." The flyer lists four main steps for safety: 1) Read the label, 2) Keep materials from children, 3) Keep chemicals in the original label container, and 4) dispose of empty containers promptly. The flyer stresses the importance of calling a doctor without delay in case of accident. Two sources of emergency medical information concerning poisoning are listed: Dr. Wayland J. Hayes, Jr., Savannah, Georgia, office phone 37741, home 27618; or Dr. Griffith E. Quinby, Wenatchee, Washington, office phone Normandy 2-5506, home Normandy 3-3181.

* * *

This will be a good year to test the effectiveness of modern merchandising methods. Certainly farmers are going to hold on to every dollar possible—by the same token they've demonstrated before they'll spend a dollar if you can make them a profit on it. Certainly farm chemicals are one of the best investments farmers can make. While every company has a responsibility to sell its own products and make its own profits and/or losses, the success of one company can help others also, for as farmers become more "farm chemical conscious" everyone benefits, including farmers and consumers. Good luck to everyone!

* * *

While the Interstate Commerce Commission did act last month to okay a general 6% increase in freight rates effective March 7th, substantial concessions were made to the fertilizer industry following the appearance of numerous industry witnesses before the ICC to protest the proposed advance. A strong brief was filed by Paul T. Truitt, executive vice president of the National Plant Food Institute, and the proposed advances were also opposed by Secretary of Agriculture, Ezra Taft Benson. The rate increase on phosphate rock will be limited to 30¢ per ton and on potash and potash fertilizer materials to 50¢ per ton, considerably less than the advances originally requested.

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TRIANGLE BRAND COPPER SULPHATE

IN YOUR FUNGICIDE AND FERTILIZER FORMULATIONS

Since 1885, successful growers have preferred Triangle Brand Copper Sulphate in fungicides. It has consistently proved itself more effective and superior to organic materials; in sprays, where Bordeaux Mixture is the most reliable, or in dusts, if preferred.

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INSTANT (powder) for quick and efficient mixing of Bordeaux sprays.

DIAMOND (snow) small or large crystals, all containing 25.2% metallic copper.

BASIC Copper Sulphate in powder form, containing 53% metallic copper.

Contact us today for further information on TRIANGLE BRAND COPPER SULPHATE and its use in your agricultural formulations.

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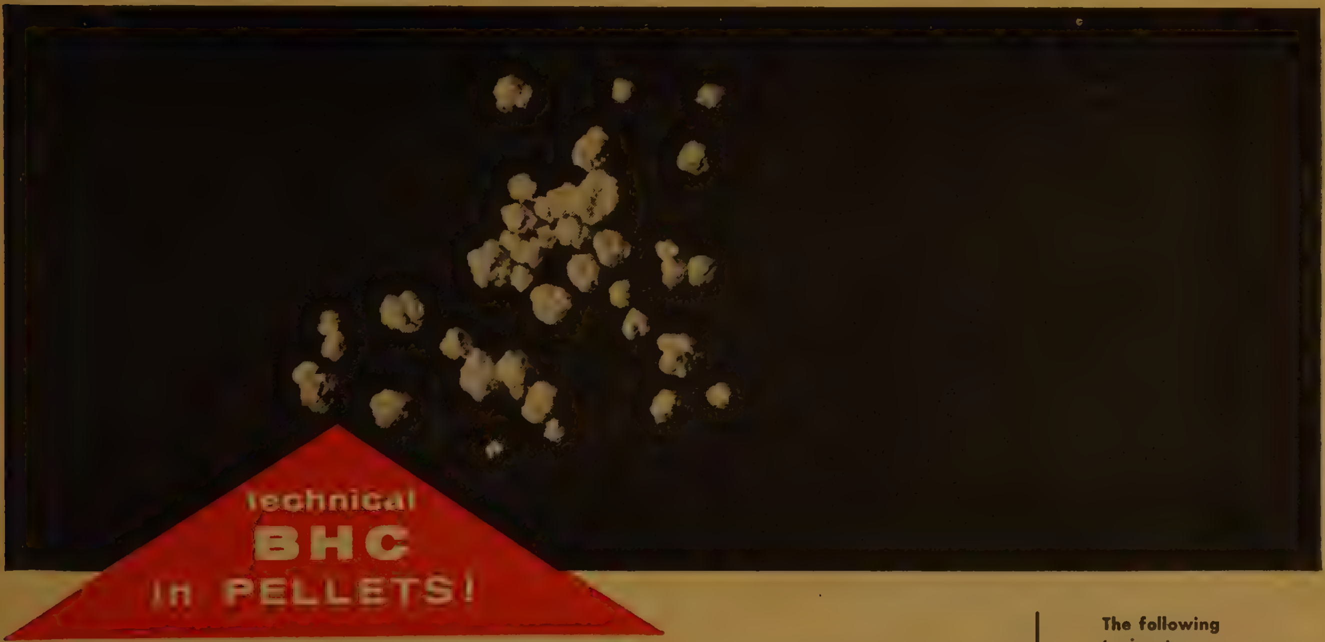
Stauffer Dust Bases are Production-tested for every factor that affects the Formulator's Profits

Every Stauffer Dust Base is prepared for the formulator's use. None is offered to the market until rigid tests have *proved* that diluents and other inerts are compatible with the widest range of toxicants . . . that they will not inhibit toxicant action . . . that they contribute to shelf life and efficiency . . . that they will not abrade equipment.

Stauffer plants and offices provide scientific and practical service geared to the needs of growers and formulators throughout the year.



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Weeds incur danger and great economic losses . . . they steal from crops . . . they constitute a fire hazard without equal. Nonselective BORATE weed killers attack this menace most effectively by destroying roots and rhizomes and preventing regrowth for long periods. During our long experience with borates for weed control, we have developed special weed killers capable of destroying all types of weeds and grasses under the many various local and regional conditions.

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- **EASY APPLICATION . . . SAFETY**
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- **NONSELECTIVE** • **NONPOISONOUS**
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A combination of 2,4-D and sodium borates. Kills deep-rooted, noxious weeds. Low application rates for maximum control with the utmost economy; use the PCB Spreader. *(Not intended for control of grass.)*

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Highly soluble; for spray or dry application. It gives a quick knock-down; destroys topgrowth and roots. A general nonselective herbicide.

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SUPERINTENDENT RUNS OUR PLANTS

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Visit our Florida Phosphate Operations. You'll see the result of nearly 50 years of research and development in mining and refining methods. You'll see plants built in anticipation of the expansion of fertilizer demand. You'll see a great team of production people. Then you'll know why it's good business to depend on *International* for phosphates.

FOR INDUSTRY
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- for the manufacture of complete fertilizers.
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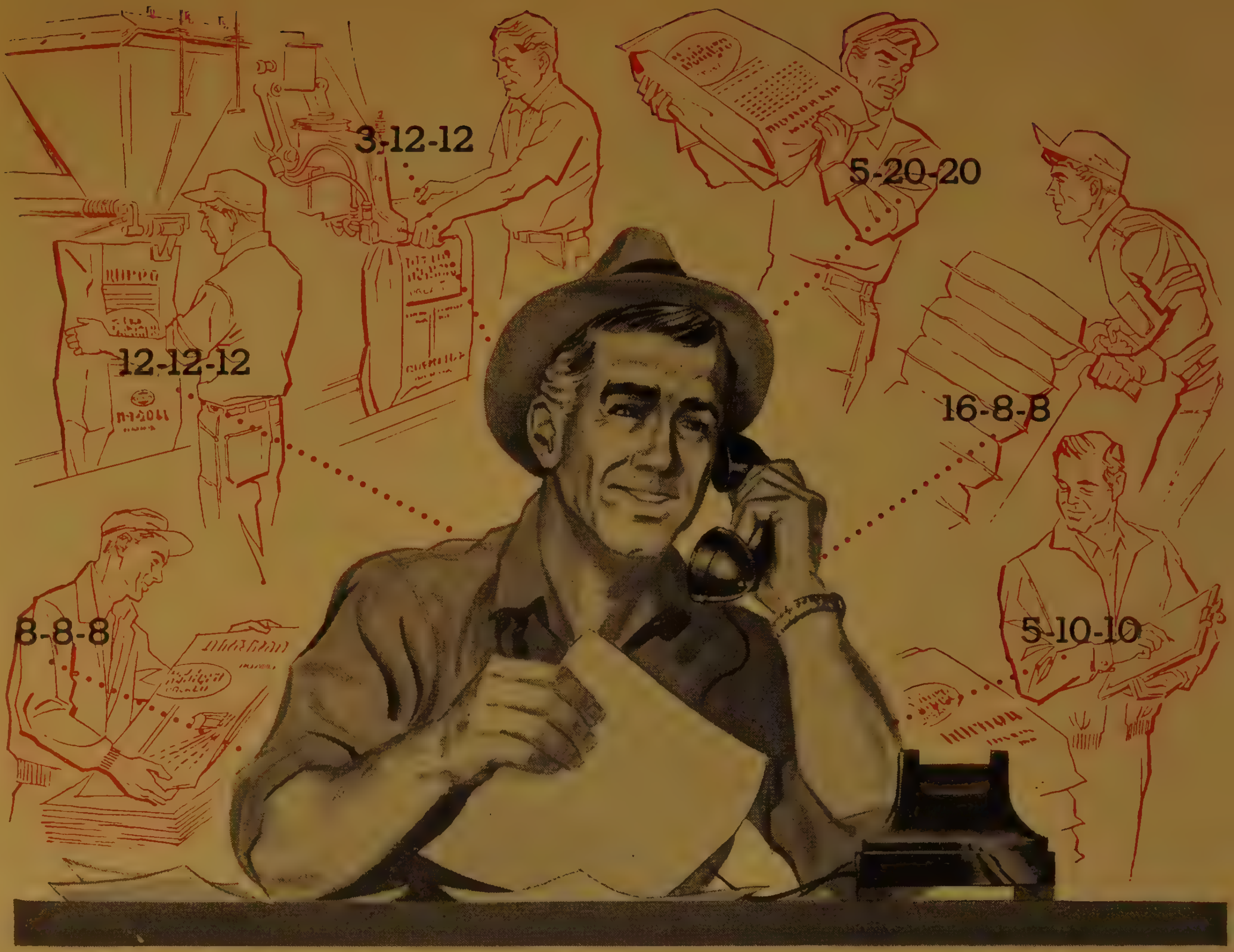
GENERAL OFFICES: 20 N. WACKER DR., CHICAGO 6 • Phosphate Mines and Plants in Florida at Noralyn, Peace Valley, Achan, Mulberry; in Tennessee at Mt. Pleasant and Wales



There's a solution at Sohio that fits your needs exactly

SOHIO's complete line of nitrogen solutions opens new opportunities in formulation for fertilizer manufacturers . . . no other nitrogen producer offers a more complete line.

The broad selection of physical and chemical characteristics, total nitrogen content, and percentage of free ammonia in Sohio's solutions line means greater freedom in formulation . . . more flexibility in manufacture . . . and a better chance to cut your costs.

Sohio's technical service staff will be happy to help you select the exact solution that best fits your own needs . . . the one that produces best results at lowest cost.

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In a hurry? Call Sohio. You'll get unmatched service and fast delivery.

Sohio's new truck fleet assures super-fast delivery within trucking area . . . and the 5 rail lines that serve Lima — Nickle Plate; Baltimore and Ohio; Erie; Pennsylvania; and Detroit, Toledo and Ironton, provide excellent service to all points. Sohio's loading facilities and large storage capacity assure rapid servicing of every order.

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Proper Formulation Assures Positive Action . . .

A pesticide formulation built on Diluex or Diluex A will give the best assurance of adequate field performance. Foilage penetration, uniform coverage, improved adhesion, and minimum toxicant fractionation can be obtained in dusts properly conditioned with these quality products.

. . . and on the *underside* of the plant leaves, too!

GRANULAR PESTICIDE FORMULATIONS

Adsorptive FLOREX granules offer a superior base for granular soil pesticides, mosquito control formulations and insecticide-fertilizer additives. Available in standard meshes 30/40, 30/60, and 16/30. Special meshes tailored for experimental formulas.

Write for complete specifications and samples; our technicians are available to help with your processing operations.

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YOU Increase PROFITS

When Lion
- A Leader in Petro-Chemicals -
Supplies Your NITROGEN NEEDS

HERE'S THE LION LINE-UP OF QUALITY NITROGEN FERTILIZER MATERIALS

Lion Anhydrous Ammonia—82.2% nitrogen. Quality guaranteed.

Lion Aqua Ammonia—Ammonia content about 30%—other grades to suit your requirements.

Lion Ammonium Nitrate Fertilizer—Improved spherical pellets. Guaranteed 33.5% nitrogen.

Lion Nitrogen Fertilizer Solutions—Various types to suit your particular manufacturing needs.

Lion Sulphate of Ammonia—White, uniform, free flowing crystals. Guaranteed 21% nitrogen.

Now that the new fertilizer manufacturing season is in full swing, make sure you realize all the profits your plant can produce. *Where you buy* your raw materials can be vital and now, more than ever before, it pays to buy *your nitrogen needs* from Lion—a leader!

Lion nitrogen products are manufactured under rigid controls to meet exacting specifications—ending the costly production delays that result when ingredients vary in quality from day to day. With Lion products, you produce with maximum efficiency and profit—and you maintain the quality standards your customers demand.

Lion also provides an expert technical staff to assist you in solving difficult formulation and processing problems. And, throughout the year, Lion's sales building advertising tells farmers the plant food story—for your benefit. Lion's leadership in customer service stands out, offering you outstanding opportunities for increased profits—and your best season yet!

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LION OIL COMPANY
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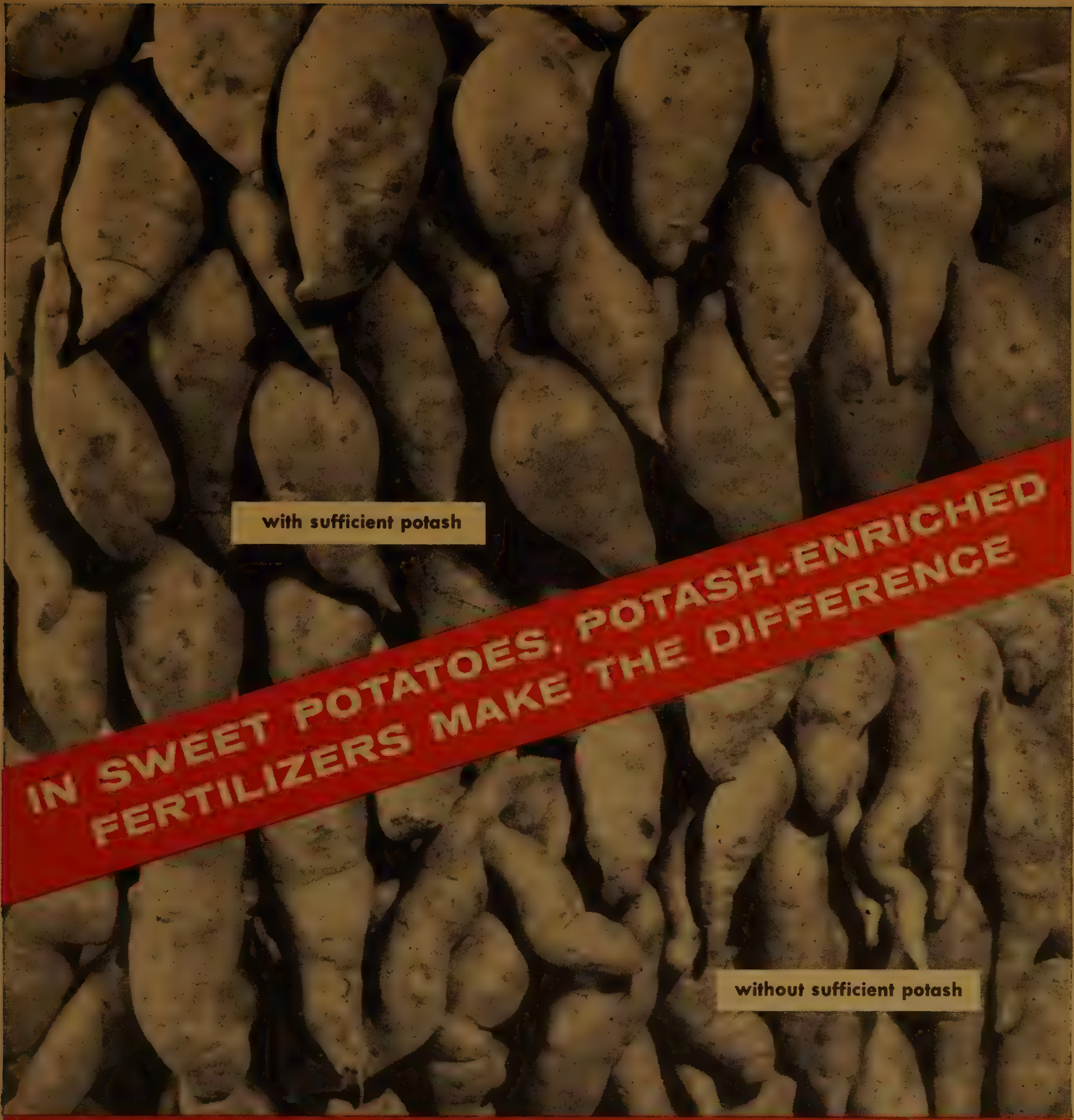
with sufficient potash
IN SWEET POTATOES, POTASH-ENRICHED FERTILIZERS MAKE THE DIFFERENCE
without sufficient potash

Using balanced fertilizers farmers are able to improve nutrition-poor soils and produce healthy, vigorous, and profitable crops. Potash is an essential partner in a balanced fertilizer, building crop resistance to disease, improving the quality of the crop, and increasing yield.

U.S.P.'s high-grade muriate of potash has the highest K_2O content and is free-flowing and non-caking—important advantages in the manufacture of these modern fertilizers which help American farmers to better crops and better incomes.

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HIGRADE MURIATE OF POTASH 62/63% K_2O
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WHEN YOU BUY *Niagara* YOU BUY PROTECTION

VANCIDE

An Exceptional New Fruit Fungicide Of Proven Merit

FULLY PROVED Niagara Vancide is a remarkable new fruit fungicide, having an unusual combination of desirable properties. This material has been on test for six years and in all fruit producing areas. It has been tested and approved by leading Experiment Station workers. And Niagara Vancide has been used in commercial orchards in most of the leading fruit growing areas for two full seasons with exceptional benefits to growers. It's now ready to go to work for you.

EFFECT ON FOLIAGE AND FRUIT In Niagara Vancide, growers get a mild, non-caustic fungicide that leaves no spotting effects on either foliage or fruit. It can be used on *all varieties* of apples, including Red Delicious, Baldwin and others that have been susceptible to injury by certain fungicides. Storage tests and the actual experience of leading growers demonstrate that Vancide sprayed apples have outstanding keeping qualities.

AVAILABLE IN TWO TYPES There are two Vancide formulations currently recommended. Vancide "A" is for early season primary scab control on apples. Vancide "M" is for season-long use to control scab and other diseases especially on russet-susceptible varieties as well as for any variety through the cover sprays.

PROPERTIES AND BENEFITS Niagara Vancide not only gives exceptional control over apple scab but has shown effectiveness over certain other important apple diseases. Its use has produced fruit of highest color, finest finish. Vancide is compatible with all insecticides, hence fits well into any combination program.

USAGE AND AVAILABILITY Both formulations of Niagara Vancide are furnished as wettable powders. They are easy-to-handle, non-toxic and non-irritating to the user. Vancide is available this year for limited commercial use. Be among the first to profit from its benefits. See your Niagara field man or write us for literature.

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Food Machinery and Chemical Corporation

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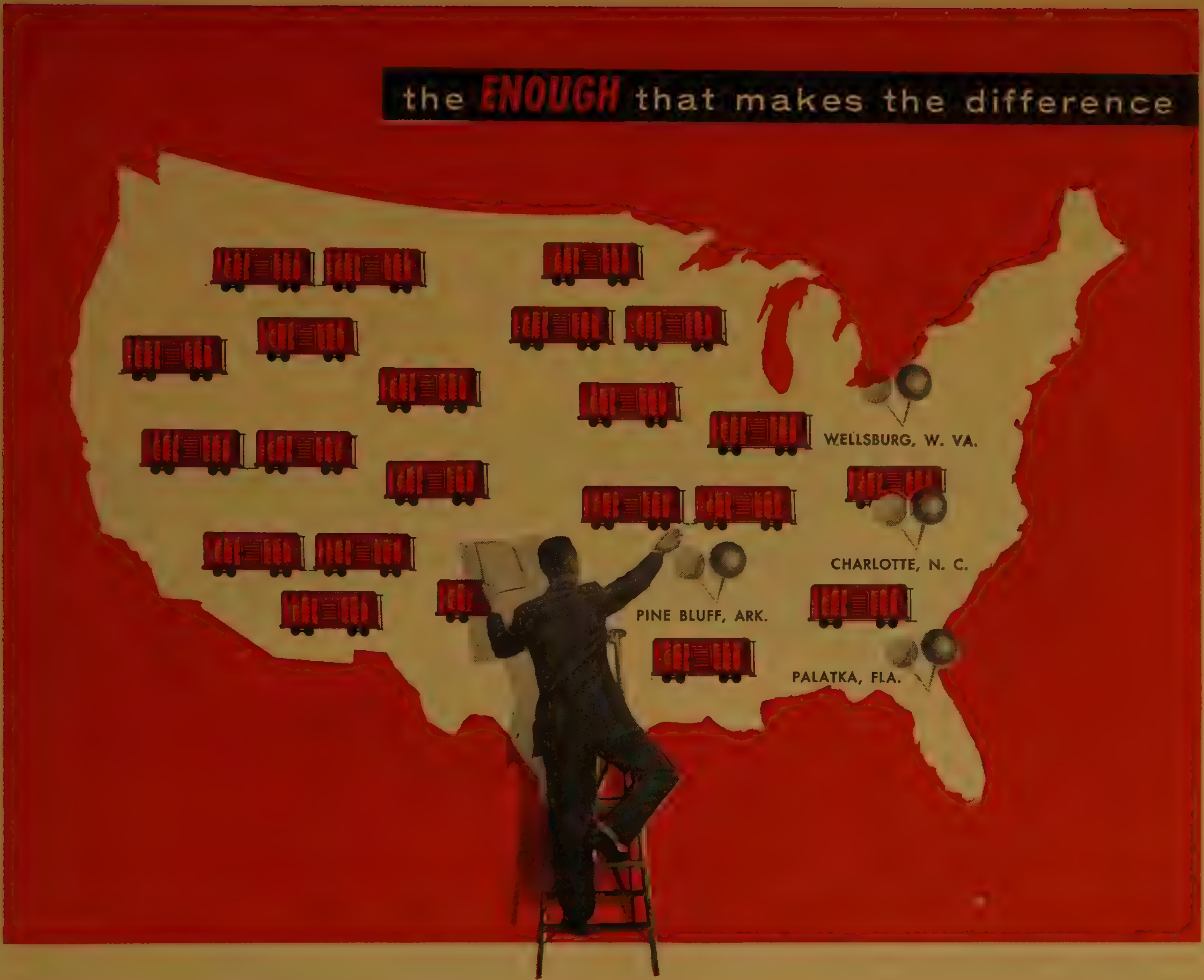
Canadian Associate: NIAGARA BRAND SPRAY CO., LTD., Burlington, Ontario

WHEN YOU BUY *Niagara* YOU BUY PROTECTION *Trade Mark


the ENOUGH that makes the difference
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CONTROLLED SCHEDULING *is easier on the nerves!*

Complete integration from trees to strategically located plants makes centralized and controlled scheduling of Multiwall Sacks a reality at Hudson.

Our traffic board is tonic for the jangled nerves of harassed purchasing men. From the moment your order comes in to Hudson it is carefully scheduled and transmitted to insure delivery to your plant . . . on time and as you want it.

Central plotting continues while the order is in progress through every phase, and daily quality control checks are posted. More than just timely delivery, Hudson Multiwalls arrive with weight accuracy and skilled craftsmanship.

When you need them most, boxcars have a habit of becoming needles in the haystack . . . Hudson's Controlled Scheduling keeps them in sight, 'round the clock and to your door.

THE WHOLLY INTEGRATED OPERATION DELIVERS ON TIME!

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A
Winning Hand . . .
5 PHILLIPS
Fertilizer
Materials for
High
Analysis
Mixtures

1 Ammonium Sulfate

New Premium Quality Phillips *66* Ammonium Sulfate contains 21% nitrogen, 23.8% sulfur. It is *dry*-cured to remove excess moisture, prevent caking. Uniform dust-free crystals flow freely, mix easily. Ideal for all analyses of mixed goods and for direct application. Available in bags or bulk.

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Phillips *66* Agricultural Ammonia contains 82% nitrogen. It's a convenient, economical source of nitrogen for formulation. Tank car shipments are assured to Phillips contract customers by Phillips huge production facilities in the Texas Panhandle and at Adams Terminal near Houston, Texas.

3 Nitrogen Solutions

Get more N per dollar! There are three Phillips *66* Nitrogen Solutions for use in preparation of high-analysis fertilizers and the ammoniation of superphosphate. These solutions keep handling costs low; help rapid, thorough curing.

4 Ammonium Nitrate

Phillips *66* Prilled Ammonium Nitrate contains 33.5% nitrogen. The small, coated prills or pellets resist caking, handle easily. Depend on Phillips *66* Prilled Ammonium Nitrate for uniform free-flowing properties in formulations and top-notch crop response as a direct application material.

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Phillips *66* Triple Superphosphate contains 46% available phosphoric acid. Ideal for use in formulation of high-analysis fertilizers.

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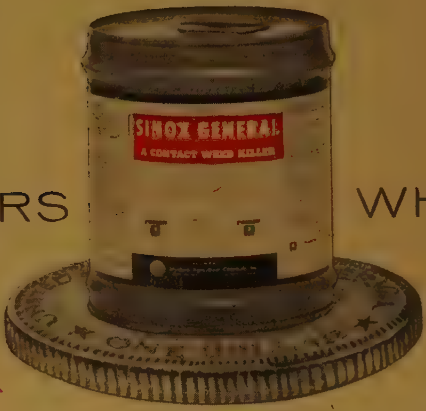
FOR DEALERS AND GROWERS WHO



STANDARDIZE

Standard's complete line of agricultural chemicals, headed by Sinox PE, Sinox General and Elgetol, is profitable both for the men who use the products and those who handle them.

Growers who have tried Sinox PE for pre-emergence spraying of sweet corn, potatoes, beans and peas—and early summer treatment of alfalfa and clover—have been well satisfied with the performance of this formulation on stubborn weeds.

Sinox General is the widely accepted desiccant for seed alfalfa, clovers, milo, flax and Sudan Grass. It has also achieved popularity as a chemical "weed mower" . . . used by Vineyardists, Irrigation Districts, Orchardists and Farmers (for killing weeds and potato vines).

Dealers in areas where orchardists have adopted chemical blossom thinning for their apple crops find that Elgetol dinitro compounds are a fast-moving item because of the cost advantage over hand labor.

We also offer a complete line of Herbicides and other pesticides. Write today for complete information.

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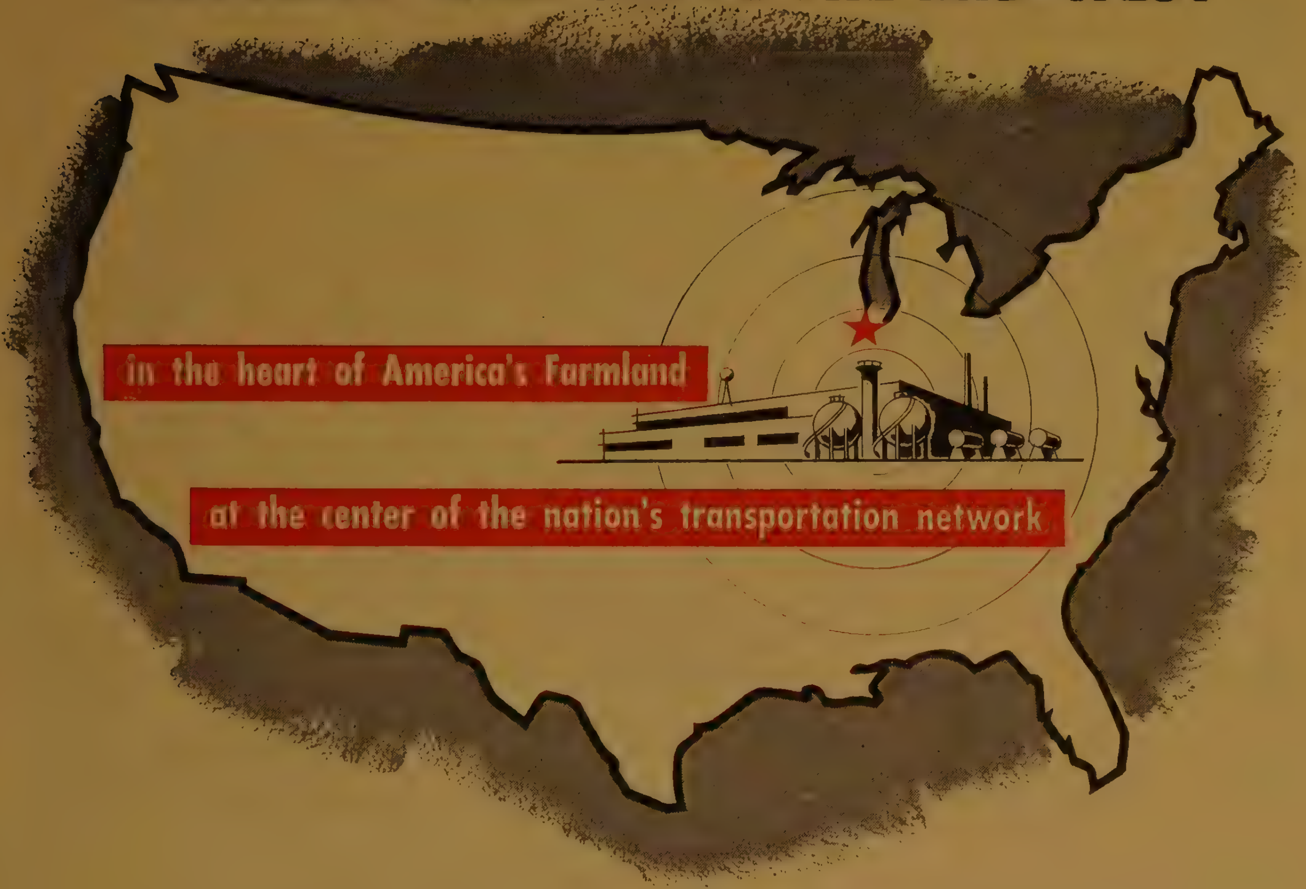
A new source for nitrogen chemicals

SINCLAIR WILL SERVE THE MID-WEST


in the heart of America's Farmland
at the center of the nation's transportation network

Strategically located in Hammond, Indiana, this ultra-modern plant will soon be on stream — producing high purity anhydrous ammonia and nitrogen fertilizer solutions for agriculture and industry.

The central location of this plant is of prime importance to you. It means *fast, low cost delivery* of your nitrogen needs via Sinclair's fleet of tank cars and tank trucks. Moreover, vast storage facilities will enable Sinclair to supply you with top quality products during your busiest periods.

For further information about how this new plant can meet your nitrogen supply problems, phone or write . . .

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(Affiliate of Sinclair Refining Company)

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Prove to Yourself the 3 Advantages of
TRITON X-151 and TRITON X-171

- Storage Stability
- Performance
- Simplified Operations

Emulsifiable concentrates with excellent *storage* stability and performance are made with TRITON X-151 or TRITON X-171.

Check the important advantages you get by using these TRITON emulsifiers in your agricultural formulations:

Stability during long storage—accelerated storage tests made in our laboratories, and by many of our customers show that TRITON X-151 and TRITON X-171 outperform other emulsifiers in resistance to breakdown during long storage of concentrates. This points out just one of the many facts which help explain their fast-growing acceptance: Ether-type emulsifiers, such as the TRITON emulsifiers, are more stable than ester-type products under the varied conditions of storage encountered in the field.

Performance—field and laboratory results show uniformly good performance of emulsifiable concentrates using TRITON X-151 and TRITON X-171 alone or in conjunction with each other. These two TRITON emulsifiers offer outstanding spontaneity and stability to pesticide emulsions. Their versatility enables them to handle a wide variety of toxicant-solvent systems in waters of varying hardness.

Simplified Operations—TRITON X-151 and TRITON X-171 alone will handle practically *all* your emulsification problems. There is no need to purchase and store an assortment of emulsifiers . . . and with TRITON X-151 or X-171 in your formulations, your spring rush schedules need not be upset by reworking of faulty concentrates left in storage as carry-over from a previous season.

TRITON is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.

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NEW TREND IN AMMONIA PLANTS

LUMMUS' 60 T/D UNIT FOR WESTVACO

One of the least expensive ammonia plants ever built went on stream in October 1955 at the South Charleston, West Virginia plant of the Westvaco Chlor-Alkali Division, Food Machinery and Chemical Corporation.

It is a small, automatic unit designed to operate with a labor force of two operators per shift, and produce 60 tons per day of anhydrous ammonia from waste chlorine cell hydrogen. Carefully designed and engineered for low investment and low operating costs, and incorporating all the latest safety features, the plant will have an unusually short payout time.

This small, minimum investment unit may well be the prototype for agricultural and industrial ammonia plants of the future. Because ammonia cannot be shipped over long distances, many such units, properly placed at hydrogen, natural gas, fuel oil and other sources throughout the country, would conveniently serve limited local areas.

Lummus built the plant around existing Westvaco facilities in an extremely confined area (as shown in the above photograph) without interrupting any normal plant operations, yet completed the job ahead of schedule in a brief seven months, with an excellent start-up. Westvaco was pleased with the job all along the line, from idea through operation.

This is one of four ammonia projects by Lummus in the last two years, and adds another to the 700-plus major installations completed by Lummus throughout the world.

May we work with you on your next project?

The Lummus Company, 385 Madison Avenue, New York 17, New York. *Engineering and Sales Offices:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pa. *Fabricated Piping Plant:* East Chicago, Ind.

LUMMUS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR
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no wonder they fell *for each other!*

ALBEMARLE with its own vast resources of Kraft Papers, Raymond with its extensive manufacturing facilities, are now "wedded" as a wholly integrated operation for producing Multiwall Paper Shipping Sacks to meet your most exacting needs.

Any required number of plies, clean colorful printing and the finest Multiwall Kraft Papers, including such specialties as asphalt laminated kraft, colored kraft, creped kraft, waxed kraft and wet-strength kraft—all direct from the Albemarle Mills.

With the assurance of prompt deliveries always!

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MULTIWALL PAPER SHIPPING SACKS

Technical SECTION

Insect-Resistant Packages Studied By Government

RESULTS of a cooperative research study between the U.S.D.A. and the Quartermaster Corps have shown new factors to be considered in the development of insect-resistant packages. The experiments, under way at the Stored-Product Insects Laboratory, Savannah, Ga. since 1950, have led to the following conclusions:

(1) paper bags appear to offer excellent possibilities for adaptation to insectproofing and from 9 to 12 months' protection can be expected with multiwalled paper bags having a synergized pyrethrum treatment applied on the outside ply: (2) lindane and methoxychlor appear to show great promise for possible use as protective coatings; (3) more effective insecticide treatments will have to be found if textile bags are to be made insectproof for periods extending over 6 months: (4) insecticide treatments on paper shipping boxes are not sufficiently effective to prevent insects from entering the package if open seams are present; to overcome this it is necessary to develop either boxes which are structurally more resistant to insect entrance or more effective insecticide coatings; (5) needle punctures on paper bags must be overtaped in order to obtain complete exclusion of insects and to derive the maximum benefits from insecticide treatments applied to the bags; (6) sleeve valves are an important mode of entry for insects and it may be possible to design more effective folds for the sleeves to limit insect entrance; (7) the deposit of pyrethrum-piperonyl butoxide deteriorates rapidly when exposed to warehouse conditions but to a much less degree on rolled paper stored in darkness; (8) the greater part of the protection provided by the pyrethrum-piperonyl butoxide treatment can be explained on the basis of repellency rather than toxicity; (9) there exist several possibilities for the improvement of the effectiveness and duration of the pyrethrum-piperonyl butoxide treatment through the use of compounds which activate or extend the activity of the treatment; (10) it may be possible to substitute effective repellents in place of the pyrethrum treatment to accomplish the same end since the protection provided by synergized pyrethrum appears to be based on the fact that it repels stored-product insects.

The Status of Federal Research on the Development of Insect-Resistant Packages, Hamilton Laudani and Dean F. Davis. *TAPPI*, Vol. 38, No. 6. June, 1955.

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Phygon for Aquatic Weeds

Phygon-XL, a fungicide made by Naugatuck Chemical division, U. S. Rubber Co., has successfully controlled water milfoil, major aquatic weed pest in New Jersey. State-wide tests during 1955 showed the chemical to be effective on water milfoil. When used at suggested dosages, it will not kill fish or present a hazard to humans or animals. Fifteen pounds of the chemical for each acre of water surface will control weed growth for the full summer season. New Jersey has recommended the chemical for trial use this summer.

Dalapon Controls Cotton Weed

Application of Dalapon as a foliar spray to Johnson grass has shown promising results in controlling this perennial weed found in cotton growing areas. While the cotton is killed or seriously injured in the spots actually sprayed, the final stand is not reduced any more than usually occurs from repeated hoeing, results of experiments in Mississippi have shown.

Dalapon sodium salt 85 percent at a concentration of 1/5 pound per gallon of water gave excellent control. Correct timing of applications was very important, and follow-up treatments were essential. It is recommended that the first treatment be given when the grass is 6-8 inches high. Subsequent treatments should be made at three week intervals, three times. This program has given 95-98 percent control of the established Johnson grass with a high degree of rhizome kill. Controlling Established Johnson Grass in Cotton by Spot Treating with Dalapon, A. J. Watson, *Down to Earth*, Vol. II, No. 3, Winter, 1955.

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New TVA Fertilizer Process

TVA has developed, on a laboratory scale, a single operation method for the manufacture of ammonium phosphate-nitrate. Neutralization of a hot phosphoric-nitric acid mixture with ammonia has been accomplished so successfully in the lab that pilot plant studies may soon be underway.

The experiments of TVA were done in this way:

Take a 21-inch tower, 18 mm. in diameter, to hold the heated acid mixture. Try a temperature range from 179° to 200° C., measuring heat with a series of thermocouples placed in wells along the length of the tower. Add ammonia. Water formed is evaporated by high temperature of the exothermic reaction. Catch the essentially anhydrous molten product in a receiver at the bottom of the tower. At 170° the ammonium phosphate-nitrate may contain 0.2 to 0.6% water; at 200° C., 0.1%.

Use of nitric acid in the operation offers some advantages over sulfuric, and may be used in making fertilizers of the phosphate-sulfate type to tie up additional ammonia. Nitric gives a higher concentration of nitrogen, and the phosphate-nitrate product is equal to ammonium phosphate- sulfate in freedom from hazard as a promoter of combustion. *Industrial and Engineering Chemistry*, Vol. 47, No. 11, Nov., 1955.

N-Subst. Acetamides Tested

Of 69 compounds of the N-substituted acetamide group tested as insecticides and acaricides in the U.S. D.A. laboratory, Anaheim, Calif., ten showed 90-100 percent kill at five percent concentration, but at one percent only three showed at least 60 percent kill. Against larvae of the celery leaf tier, none of the 22 compounds tested were effective even at five percent.

Against nymphs of the large milkweed bug, 19 compounds gave 90-100 percent mortality at five percent concentration; against pea aphid, all 68 compounds killed 90-100 percent at five percent; and against the adult citrus red mite, indications were that most of the compounds are better acaricides than insecticides. Screening Tests of Some N-Substituted Acetamides as Insecticides and Acaricides, S. I. Gertler and A. P. Yerington, U. S. D. A., Bulletin ARS-33-14.

Lead Arsenate for Pine

Spraying leaders of white pine with a concentrated spray of lead arsenate in the early spring has proved to be the most effective and least expensive method of controlling the white pine weevil in Maine.

The spray is applied anytime in late March or April, and it remains effective until early July. The entire leader and terminal buds should be covered with a thick, concentrated spray. First spray is applied when the trees are 3 to 5 feet high. Insecticide is applied with a hand-operated knapsack sprayer. White Pine—Nature's Gift to New England, Protect it From the White Pine Weevil, Charles O. Dirks, *Maine Farm Research*, Vol. 3, No. 3., Fall, 1955.

See More Moth Damage

Heavy infestations in blighted walnuts in the Modesto orchards in northern California, indicating large overwintering of the codling moth population, have alerted farmers in the area to a more serious menace which may be expected in the '56 season.

Experiments during 1955 substantiated findings of previous years, which indicated that when applications are made with air carrier sprayers, standard lead arsenate is not as effective as DDT. In an experimental orchard at Modesto, a single DDT spray was applied in May. At harvest, the codling moth infestation in three plots averaged 0.75 percent as compared with 2.5 percent in the check.

A recommended control method suggests application of spray when the average cross sectional diameter of developing Payne walnuts ranges from 3/8″ to ½″. Treatment of late varieties, such as Franquettes, should be delayed until the latter part of June. An effective aphicide incorporated with DDT sprays against the codling moth, has been used to avoid a serious increase in the walnut aphid population. Codling Moth on Walnuts in 1955, A. E. Michelbacher and Earl Oatman, *California Agriculture*, February, 1956

Chemical Aids Road Building

Arquad 2HT, a dioctadecyl dimethyl ammonium chloride, new soil-treating chemical, now holds promise as a material to treat soil for subgrade for road beds. The chemical has been found to impart considerable hydraulic stability to many different soil types and in addition to the virtual lack of capillarity demonstrated by treated soils, it enhances compressive strength of the soils.

Use of trace amounts of Arquad 2HT materially improved the wetting properties of the compaction water

. . . . *From the Superintendent's Notebook*

PRACTICAL suggestions for production personnel, gleaned from actual experience. It is hoped to have contributions to this column from readers. Production men are invited to send in practical items of this kind which may help other men engaged in production work.

Depth Measurement Technique in Sulfuric Acid Tank

Numerous methods have been used to give a continuous reading of liquid level in a tank. One of the most popular is the "bubble pipe," which is a vertical pipe extending to within 4 inches or so of the bottom of a tank. Air is introduced into the pipe at a slow rate so that it bubbles from the bottom of the pipe. The back pressure, or the pressure required to overcome the liquid head in the tank is measured by a pressure gauge or mercury manometer calibrated to give liquid depth. When used in sulfuric acid tanks however this system gives considerable trouble even with alloy dip pipes. Corrosion will develop rapidly inside the pipe, unless the air is absolutely dry. Hence, special equipment and constant attention are required if plant air is used. Glass pipes about 2″ in diameter, however, can be used safely for long periods of time. Our first test was in a tank about 10′ deep, handling hot 98% acid. Alloy steel would last only a month or two, but glass has lasted for years.

Submitted by W. Davis, plant superintendent, Davison Chemical Co.

and allowed for uniform wetting of the soil in two test plots selected by Indiana State Highway Commission, and Union Starch and Refining Co. and the Chemical division of Armour and Co. (developers of the agent).

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Cranberry Recommendations

State of Washington recommendations for control of cranberry insects, disease and weeds include use of DDT at two pounds 50% wettable powder per 100 gallons, plus Bordeaux 10-6-100 or ziram or ferbam at 3-4 pounds per gallon to control fireworm and cotton ball pests, applied when buds break. Parathion is recommended for control, at the hook stage on blossom of oystershell scale, fireworm, fruitworm, tip worm, cotton ball and storage rots. Malathion may also be used at this stage; however, the bulletin warns not to use it in combination with Bordeaux. The same chemicals were suggested for sprays at the stage when 75 percent of the blossoms have dropped and again when all of Lecanium scale eggs have hatched. If a late spray becomes necessary, parathion, malathion, or methoxychlor are recommended.

Fungicide sprays to control rose bloom, red leaf spot and black spot are: ziram, ferbam or Bordeaux. Recommendations for Cranberry Production in Washington, Extension Service State College of Washington, February, 1956.

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Cabbage Looper Resists DDT

Arsenical and botanical insecticides, formerly used in cabbage worm control, became obsolete with the introduction of DDT in 1945. About ¼ pound of toxicant per acre gave 99 percent control of cabbage loopers in field experiments and similarly good control for the next five years. In 1951, a decrease in efficiency was noted and a 60 percent control figure in 1953 dropped to 45 percent in 1955 in New York state. Field tests in 1955 showed that increased dosages of DDT improved the control very little; however, endrin, isodrin and Shell OS-2146 gave good control of the cabbage looper in both laboratory and field tests. Other materials tested included: diazinon, dieldrin, parathion and toxaphene. The Cabbage Looper in 1955, F. L. McEwen and F. E. R. Hervey, *Farm Research,* January, 1956.

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Radioactive Fertilizer

Effect of fertilizer on plants is being studied with radioactive fertilizers by U.S.D.A., Beltsville, Md. Ordinary phosphate fertilizer is mixed with a radioactive element and the "tagged" fertilizer can then be traced even after it is taken up by plants. Some of the things learned in the 41 experiments tried by the U.S.D.A. in various parts of the U.S., Canada and India are: corn uses a high proportion of phosphate from added fertilizer early in the growing season and very little at any other period of growth; potatoes absorb phosphate throughout the growing period.

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Smut Control in Egypt

Panogen, Granosan, Granosan M., Agrosan, and Mergamma B were effective seed treatments for the control of bunt and flag smut of wheat and covered smut of barley in experiments reported in Egypt. Mercuric chloride was effective against bunt only and Ceresan gave good control of flag smut and covered smut. Benzene hexachloride and sulfur were ineffective against all three smuts. Chemical Seed Treatments for the Control of Wheat and Barley Smuts in Egypt, Tewfik Abdel-Hak, Egypt, Ministry Agr. Plant Disease Sect. Tech. Bulletin; through *Chemical Abstracts,* Vol. 49, No. 17, p. 11936.

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No Immediate Cure For Mites

Until a superior miticide is found—and an intensive search for such a material is under way—producers of fruits, flowers, vegetables and cotton who are faced with infestations of resistant spider mites must depend upon biological factors to effect control, or put up with some crop losses.

This is the conclusion which was reached last month by entomologists of the U.S. Department of Agriculture. The USDA research indicates that the ability of mites to "resist" or withstand the toxic effects of all present-day miticides is an inherited trait, one not likely to be "lost" from or bred out of mites that have it. Proof of this factor was established at USDA's Beltsville, Md., research center where cross breeding of three different strains of two species of mites was conducted.

DDT Residues on Corn

Although residue analyses have shown consistently that there are either no residues or only insignificant amounts of DDT on the kernels and cob of fresh market corn, residues ranging from 283 ppm to 7.1 ppm have been found on the husks, silks, leaves, and stalks of treated plants. High DDT residues on sweet corn forage present a serious problem to dairymen because cows on a diet containing DDT secrete this substance in their milk. Federal laws do not allow any DDT in milk, and California state laws forbid selling forage that contains more than seven ppm of DDT.

Tests at Riverside and San Jose showed that the lowest residues on husks and silks result from broadcast dust applications. Depending on the concentration of dust used, and the number of applications, residues of from 7.1 to 12.0 ppm were found.

Data obtained in Kern County indicated that the largest DDT residues on leaves and stalks occurred when individual ear brush dusting and fixed nozzle boom spray applications were used. Smallest residues resulted from individual ear spray treatments and airplane dust applications.

It is recommended (since there is no practical method of eliminating DDT residues from sweet corn once the insecticide has been applied) that sweet corn fodder, treated with DDT, should not be fed to dairy animals and it should not be fed to meat animals being fattened for slaughter. DDT Residues on Sweet Corn, Oscar G. Bacon and Wallace R. Erwin, *California Agriculture,* Feb., 1956.

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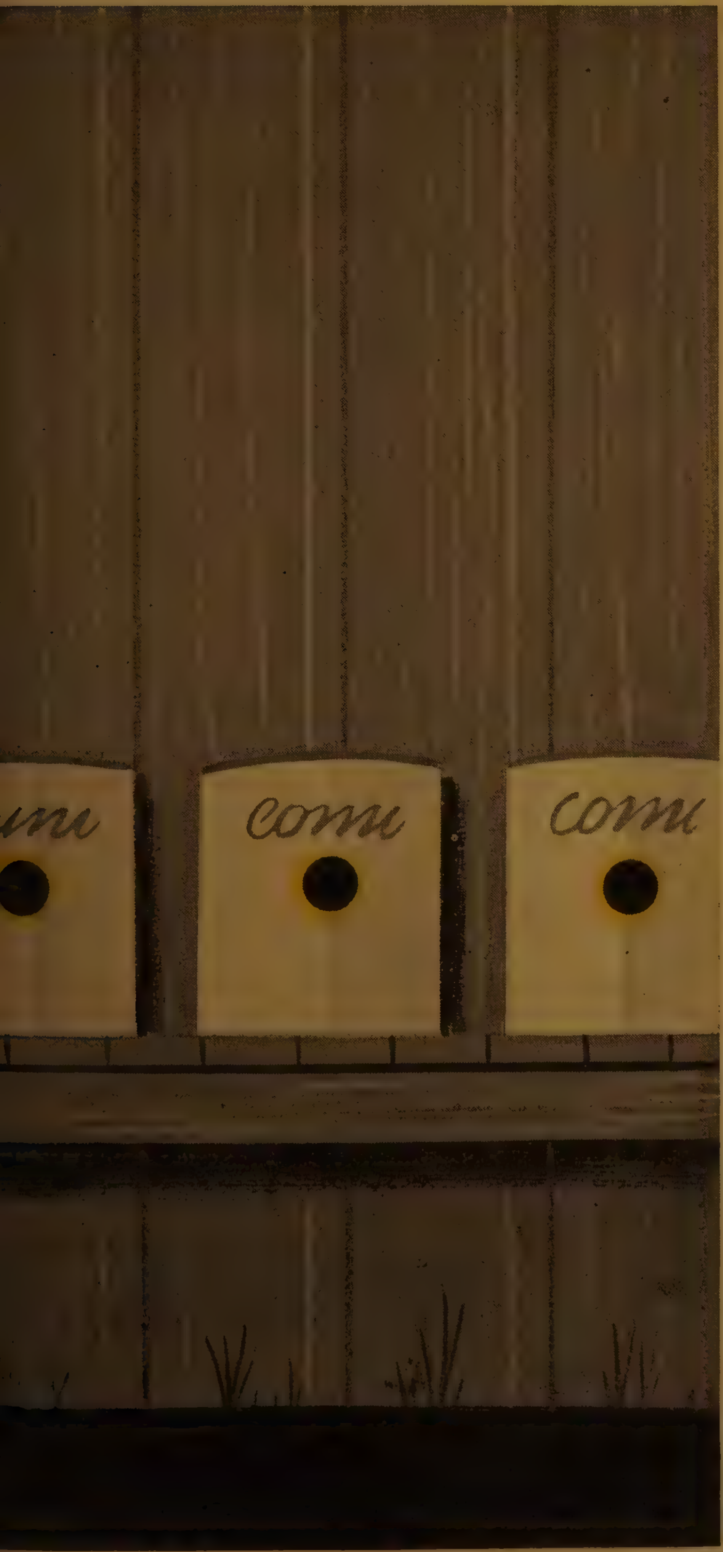

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Dithane, Parzate for Leaf Blight

Control of South American leaf blight was obtained by spraying Hevea trees with Dithane Z-78 or Parzate. Applications of Dithane at 8-day intervals proved more effective than applications of a copper fungicide (previously the standard control fungicide) at 4-day intervals. Larger leaves and more vigorous growth were noted. Control of South American Leaf Blight by Use of a New Fungicide, M. N. Langford and H. Echeverri, USDA, San Jose, Costa Rica; through *Chemical Abstracts*, Vol. 49, No. 17, P. 11935.

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Booklet on Termite Control

The latest information on how to control termites is available in a four-page booklet entitled *Termite Control with Dieldrin*. The booklet was prepared by Shell Chemical Corp., New York. It tells how to detect termites and, in a series of illustrations, shows how pest control operators control them with dieldrin. Three types of buildings are considered: those with crawl space between the floor and the ground, those with a concrete floor flush against the ground, and those with basements. Dosage rates per square feet are also explained.

The booklet includes a brief history of the pests, their social organization, and the extent of their yearly damage. One section deals with the resemblance of termites to "white ants" and gives hints on distinguishing between them. The effectiveness of dieldrin for long-time protection against termites in the soil is brought out in the final section of the booklet.

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CMU For Pineapple Weeds

Two applications per year of 80 percent CMU at 2.5 lb./acre gave almost complete control of weeds in pineapple plantings in French Guinea without any reported damage to the crop. About five pounds of CMU were required to kill off sedge-type weeds. The Effectiveness of CMU in Pineapple Plantations, Claude Py, *Fruits* (Paris) 10, 157-161 (1955).

LITERATURE AVAILABLE

The following list reviews a series of bulletins on fertilizer, insecticide and fungicide recommendations, controls, etc. For the most part, these bulletins and reports are prepared by the various state agricultural experiment stations, and copies may be obtained by writing directly to the respective stations.

Effect of Varying the Volatilization of Methyl Bromide by Combinations With Various Solvents on Its Distribution in Bulk Grain Fumigation by N. M. Dennis and W. K. Whitney. Laboratory test made to investigate behavior of methyl bromide and mixtures of methyl bromide with various solvents, in the fumigation of bulk wheat and milled products, showed that changing the rate of volatilization of methyl bromide by mixing it with higher boiling-point solvents did not materially change the amount of methyl bromide component associated with complete mortality of test insects in space fumigation. Penetration of methyl bromide into wheat, when applied to the surface, was materially enhanced by mixing it with higher boiling-point solvents. Bulletin AMS-73 U.S. D.A., Agricultural Marketing Service, Dec. 1955.

Protecting Stored Seed From Insect Attack. Prepared by Stored-Product Insects Section, Biological Sciences Branch, USDA, the report covers: factors affecting development of grain insects; moisture changes in seed; sources of infestation; preventive measures; bin sanitation; warehouse sanitation, fumigation; use of naphthalene and paradichlorobenzene; use of dusts for protecting seed; slurries and sprays; cold storage of seed; use of heat; aerosols and space sprays; and insect-resistant bags. Bulletin AMS-64, USDA, Agricultural Marketing Service.

A 14-Year Study of Vegetable Crop Rotations on Merrimac Fine Sandy Loam Soil in Connecticut, B. E. Janes, W. O. Drinkwater, G. Beall, J. Scarchuk, and J. M. Lent. Ten vegetable and three green manure crops were grown in various rotational sequences from 1940 to 1953 and effect of rotations on yield of certain vegetable crops and on soil organic matter was determined. Experiments included determinations of the effect of one crop on succeeding crops as well as influences affecting productiveness of the soil. Changes in organic matter of the soil were also measured. Bulletin 319, March, 1955. Storrs Agricultural Experiment Station, Univ. of Conn., Storrs, Conn.

Stored Grain Pests. Four species of insects do the major damage to grain in storage and shipment; granary weevil, rice or black weevil, lesser grain borer or Australian wheat weevil, and the Angoumois grain moth. These pests are discussed together with methods of preventing infestation. Farmers' Bulletin No. 1260, U.S.D.A.

Insect and Disease Control on Vegetables, Donald MacCreary, J. W. Heuberger and R. F. Stevens. 8-page gatefold leaflet reviews Delaware's 1956 recommendations. Extension Folder 45, January, 1956. University of Delaware, Newark, Del.

Control of Fruit Insects and Diseases in Orchards and Home Plantings, L. A. Sterns, J. W. Heuberger and R. F. Stevens. 8-page gatefold leaflet summarizes Delaware's 1956 recommendations. Extension Folder 44, January, 1956. University of Delaware, Newark, Del.

Spray Recommendations for Tree Fruits in Eastern Washington, prepared by representatives of the Experiment Stations and Extension Service of the State College of Washington, Washington State Dep't. of Agriculture and U.S.D.A. The 35-page bulletin contains spray programs and also lists precautions when using some of the newer chemicals. Extension Bulletin 419 (revised), January, 1956. Extension Service, State College of Washington, Pullman, Wash.

Foliar Analysis Results from 40 Connecticut Orchards, F. H. Emmert. In the summer of 1953, a survey was made in Connecticut in which foliar analysis and soil pH data were used to evaluate the general nutritional condition of orchards throughout the state. This 18-page booklet describes the tests methods and results. Bulletin 317, Storrs Agricultural Experiment Station, Univ. of Conn., Storrs, Conn.

Crop and Fertilizer Recommendations for Mississippi. General crop and fertilizer recommendations for 1956 are presented, based on latest research findings at State College and at the ten branch Experiment Stations. Circular 199, Jan. 1956. Mississippi State College, Agricultural Experiment Station, State College, Miss.

Annual Winter Grazing in the Coastal Plain of Georgia, B. L. Southwell and S. A. Parham. The 7-page bulletin describes test results on winter grazing crops and offers suggestions as to feeds for animals. Fertilizer recommendations for land intended for winter grazing (oats and Abruzzi rye) are given. Mimeographed Series N.S. 13, Sept., 1955. Georgia Agricultural Experiment Station, Univ. of Georgia, College of Agriculture, Athens, Ga.

LISTENING Post

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Epidemics and Identification Section, Horticultural Crops Research Branch, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

Sorghum Seed-Treatment Tests

R. W. LEUKEL of the Field Crops Research Branch, United States Department of Agriculture, R. H. Porter of the Colorado Agricultural Experiment Station, and O. J. Webster, also of the Field Crops Research Branch, report that covered kernel smut (*Sphacelotheca sorghi*) in Leoti sorgo was controlled satisfactorily in 1948, 1949, 1950 and 1953 by certain mercurial fungicides and by some non-mercurials like Phygon (Table 1). The seeds of Leoti have persistent glumes, which characteristic makes smut control more difficult in this and similar varieties than in most kafirs, the seeds of which lose their glumes in threshing.

In 1954 a quantity of Rancher sorgo seed from Brookings, South Dakota, was supplied by C. J. Franzke. The seeds of this variety also have persistent glumes, but Rancher seemed preferable to Leoti for field tests because it matures earlier, is much shorter, and is less apt to lodge.

In the 1954 tests with this variety, smut control with a mercurial disinfectant was less satisfactory than in the previous tests with Leoti (Table 1). Therefore, in 1955, to determine whether heavier applications of fungicides are necessary to control smut in Rancher and possibly in other sorgos, it was planned to apply five mercurials to infested seed of this variety at the generally recommended rates and at 1½ and 3 times those rates. Panogen and three non-mercurials were to be applied at the usual rates, and at 1½ and 2 times those rates.

To determine the possible effects of higher rates of treatment on the viability of sorghum seed, Sharon kafir seed was first treated and three lots of 100 seeds each from each treatment were planted in pans of non-sterilized soil 5 days after treatment. The pans were kept at 25° C until after emergence of the seedlings. At the same time several seeds from each treated lot were placed on small plates of water agar, rolled about gently to remove some of the smut spores, and then discarded. The plates were kept at 25° C for several days and examined periodically for spore germination. The effects on sport germination and seed germination are shown in Table 2. Only three of the fungicides applied at the heavier rates seemed

Table 1

Summary of infection by covered kernel smut in plants grown from treated and untreated seed of Leoti sorgo and of Rancher sorgo in the years indicated.

Seed treatment Fungicide	Form	Oz./bu.	Percent smut infection Leoti 1948	1949	1950	1953	Rancher 1954
Ceresan M	Slurry	½	0.1	0	0	0	—
Panogen	Liquid	¾	0	0	0	0	2.1
Phygon	Slurry	2	0.6	0.9	0	0	0.1
Arasan	Slurry	2	6.1	1.9	0	0	3.7
Spergon	Slurry	2	1.2	1.8	0	—	3.1
Orthocide	Slurry	2	—	—	—	0.9	5.0
Check	Slurry		51.1	46	33.5	60.5	30.9

Table 2

Emergence from kafir seed, variety Sharon, treated with fungicides, (a) at the standard rate, (b) and (c) at 2 and 3 times the standard rate for the mercurials, and 1.5 and 2 times for the non-mercurials, also germination of smut spores taken from the different lots of seed, 1955.

Seed Treatment No.	Fungicide	Oz. per bu. a	b	c	Percent emergence a	b	c	Percent spore germination a	b	c
1	Check				83	79	76	95	75	70
2	Ceresan M	0.5	1	1.5	84	80	88	0	0	0
3	Puraseed	0.5	1	1.5	93	86	89	2	2	0
4	MEMA	0.5	1	1.5	91	61	52	15	15	3
5	Panogen	0.75	1.5	2.25	93	66	63	25	2	0
6	Merculine	0.5	1	1.5	94	88	79	17	0	0
7	Setrete	0.5	1	1.5	91	91	86	31	0	0
8	Phygon	2	3	4	95	92	95	0	0	0
9	Orthocide	2	3	4	91	92	90	0	0	0
10	Arasan	2	3	4	92	91	91	0	0	0

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Table 3

Percent emergence and infection by covered kernel smut in Rancher sorgo grown from seed untreated or treated as shown, planted in field plots in triplicate at three stations, 1955.

No.	Seed treatment Material Form	Oz./bu.	Percent emergence Fort Collins	 Lincoln	Percent smut Fort Collins	 Lincoln	 Beltsville	 Average
1	Check		57	78	20.4	30.1	42.1	30.9
			59	79	15.8	24.5	44.9	28.4
			66	83	17.7	19.8	41.7	26.4
2	Ceresan M	0.5	59	77	5.7	8.9	10.5	8.4
	Slurry	0.75	50	80	1.5	10.0	12.6	8.0
		1.5	68	76	1.2	9.5	8.1	6.3
3.	Puraseed	0.5	61	86	7.6	20.3	33.3	20.4
	Slurry	0.75	56	73	3.4	19.2	38.0	20.2
		1.5	52	81	4.5	25.1	24.1	17.9
4	MEMA	0.5	51	66	18.6	41.9	42.9	34.5
	Liquid	0.75	53	74	9.8	23.6	33.2	22.2
		1.5	53	80	3.7	21.2	26.7	17.2
5	Panogen	0.75	57	81	20.9	38.8	36.3	32.0
	Liquid	1.12	57	81	11.2	23.0	30.7	21.6
		1.5	70	84	8.2	23.0	27.7	19.6
6	Merculine	0.5	58	82	18.6	25.5	34.7	26.3
	Liquid	0.75	56	82	14.8	25.2	27.1	22.4
		1.5	71	81	5.3	18.2	21.7	15.3
7	Setrete	0.5	57	79	16.1	24.1	35.2	25.1
	Liquid	0.75	54	80	10.8	26.7	33.3	23.6
		1.5	57	78	9.1	16.2	25.2	16.8
8	Phygon	2	55	76	0.5	4.9	4.5	3.3
	Slurry	3	48	74	0	0	3.0	1.0
		4	65	81	0	0	1.6	0.5
9	Orthocide	2	61	81	20.5	25.3	32.9	26.2
	Slurry	3	56	81	0.5	7.3	12.8	6.9
		4	65	77	0.2	0	0.8	0.3
10	Arasan	2	55	81	18.5	29.9	39.1	29.2
	Slurry	3	66	83	3.3	6.6	14.8	9.2
		4	69	83	0.2	7.1	10.6	6.0

Table 4

Percent emergence and smut-control in Combine-60 kafir, grown from untreated and from treated seed, planted in triplicate rows at each of three stations, 1955.

No.	Seed treatment Fungicide	 oz./bu.	 Form	Percent field emergence Fort Collins	 Lincoln	Percent infected heads Fort Collins	 Lincoln	 Beltsville	 Average
1	Check			61	80	28.2	36.9	60.3	41.6
2	Ceresan M	1¼	Slurry	50	80	0	0	0	0
3	Puraseed	1¼	Slurry	56	73	0.9	0.5	0.5	0.6
4	MEMA	1¼	Liquid	53	74	0	0	0.4	0.1
5	Panogen	1⅞	Liquid	57	81	0	0	0	0
6	Merculine	1¼	Liquid	56	82	0.6	2.0	0	0.3
7	Setrete	1¼	Liquid	54	80	0	0	0	0
8	Phygon	5	Slurry	48	74	0	0.5	0	0.2
9	Orthocide	5	Slurry	56	81	0.9	4.1	0.9	2.0
10	Arasan	5	Slurry	66	83	1.2	0	1.6	0.9

to depress emergence from treated seed appreciably. Five mercurials failed to inhibit spore germination completely at the lightest rate of application, two at the medium rate, and one at the heaviest rate.

Rancher seed was treated approximately as described above (Table 3) and, along with untreated seed, was planted in triplicate at three locations—Fort Collins, Colo., Lincoln, Neb., and Beltsville, Md.—at the rate of 200 seeds per row. Stand counts were made at Fort Collins and Lincoln, also at Beltsville but were valueless there because of heavy rains and soil washing. When data were taken on smut infection and control, the total heads and the smut-infected heads in each row were counted. These data along with the field data on emergence at Lincoln and Fort Collins are shown in Table 3.

For testing smut control in a variety without persistent glumes, Combine-60 kafir was used in 1955 instead of Sharon kafir because of its earlier maturity. A supply of this seed was obtained from Dr. N. W. Kramer, Lubbock, Texas. It was inoculated with spores of covered-kernel smut at a 1 to 250 spore dosage, and was to be treated at the low and medium rates used on Rancher. The nine fungicides were applied first to separate lots of seed at the lower rates (¾ oz./bu. for Panogen, ½ oz./bu. for the other five mercurials, and 2 oz./bu. for the three non-mercurials). The second series of samples was to be treated at 1½ times those rates. Through the operator's error, the first series of samples was treated also with the second application, while the second series of samples received no treatment. The error was not discovered until the data on smut infection were taken. The complete lack of any apparent smut control in one series led to an examination of the seed remnants. The presence of seed-infecting insects in these remnants indicated lack of treatment. The data taken on the plants from treated seed along with the infection data from untreated seed are shown in Table 4.

The superiority of Phygon compared with mercurials and with other *with practically no limitations*

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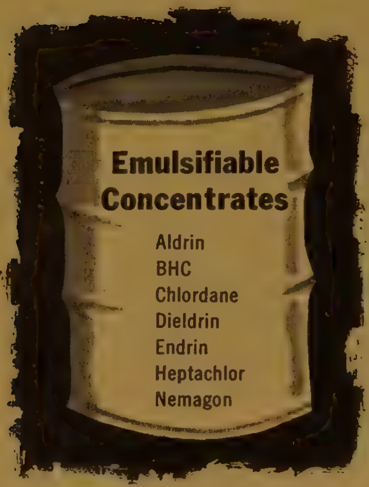

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2. Emulsions are easily formed with minimum agitation.
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4. Pesticide concentrates are also suitable for conventional aqueous spray applications in case of carry-over stock.

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For further technical information, contact your local Emulsol representative, or write direct to

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non-mercurials in controlling covered kernel smut in Rancher sorgo, especially with the heavier applications, seems to make it the logical choice as a seed disinfectant for sorghum seed with persistent glumes.

Grain Pest Infestations Up; Corn Borer Damage Down

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Economic Insect Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the U. S.

By Kelvin Dorward

Beet Leafhopper Movement Light

AN outlook statement on beet leafhopper, carrier of curly-top virus disease, has just been issued. Although subsequent surveys will be made later this spring, this first report indicates that the beet leafhopper movement from the southern breeding grounds to the cultivated districts of north and south-central Utah and western Colorado will be light. Movement to southern Utah, southern Nevada, southeastern California and central Arizona is also expected to be light. The same situation is true for the local movement from the breeding grounds of northern and eastern Utah to the adjacent cultivated districts of northern Utah and western Colorado. In the survey conducted earlier this year, it was found that the overwintering beet leafhopper population in the southern breeding area was very small. The spring host plant acreage in this area is greatly reduced over that of the last 10 years. Weather favorable to fast development could, of course, reverse this situation, but at the present beet leafhopper and host plants available point to a light movement.

The vegetable weevil was the truck crop insect causing perhaps the most concern during February and early March. This insect was causing damage to turnips in Lauderdale County, Mississippi, and mustard crops in Orange County, California, and Washington County, Arkansas. Tobacco bed infestations in Georgia ranged from light in Colquitt and Brooks County to heavy in Thomas County. The infestations were general throughout the tobacco plant bed area of southern Georgia. Florida also reported the pest from Holmes and Gadsden Counties.

Cutworms were active in Florida, attacking several crops in Palm Beach County. Lettuce, sweet corn and field corn were the principal crops hit. In one strawberry field in East Baton Rouge Parish, cutworms averaged one per plant. Controls were being applied in many strawberry fields in Tangipahoa Parish where the cutworms were one per 10 plants.

Lettuce in the Lower Rio Grande Valley of Texas was being damaged by the corn earworm. False chinch bugs were also attacking lettuce and damaging turnip leaves in the same area.

Corn Borer Loss Lower

Recently released estimates of damage by the European corn borer to grain corn in the United States in 1955 indicate loss from this insect was not as great in 1955 as in 1954. The loss for 1955 is estimated to be slightly over 155 million bushels, or approximately 5 percent of the total national crop which is estimated at 2,856,767,000 bushels. The value of the crop lost when computed at December 15, 1955 prices received by farmers is $182,581,000. This compares with an estimated dollar loss of $261,415,000 for 1954. The estimates were compiled from 959 counties in 23 States responsible for 83 percent of the total production of grain corn grown in the United States. They represent 59 percent of the counties known to be infested.

Small Grain Insects on Increase

The brown wheat mite has been found in all the northwestern and panhandle counties of Oklahoma. Texas County had the highest population reported, with counts of over 200 mites per linear foot of row common. There was some spraying in the Altus area. A survey in southwestern Kansas showed an increase in population in fall-planted wheat, especially in continuous fields. The heaviest populations were found in Meade, Seward and Stevens Counties, with many counts averaging between 50 and 75 mites per linear foot of row. In Texas, heavy populations of the winter grain mite were reported from Milam, VanZandt, Denton, Collin and Dallas Counties.

The greenbug was reported to be heavy on oats in Madison County, Texas, and one field of wheat in Castro County had a population of 75 to 125 per linear foot of row. Damaging numbers were also reported from near Chickasha, Grady County, Oklahoma. Small numbers of the insect were reported from Ottawa, Canadian, Craig and Kiowa Counties of that State. Light populations were found in several Louisiana parishes, but parasites and predators were apparently keeping the populations down.

Virginia Fruit Insect Outlook

Workers in Virginia have reported on the potential for some of the fruit insects for that State during the coming season. The red-banded leaf roller carry over is heavy in northern Virginia and in Albemarle County apple orchards, but about normal in Augusta County. Although a leaf miner carry over is heavy in apple orchards of the northern area, about 75 percent are parasitized. Plum curculio populations in peach orchards of the eastern and tidewater area are extremely high, with counts of at least 1,000 per acre in the latter section. Counts

(*Continued on Page* 128)

INDUSTRY News

Al Fuchs Heads Atlas Ag.

Albert F. Fuchs, formerly assistant sales manager, agricultural chemicals, of Diamond Alkali Company, Cleveland, has just taken over control and management of Atlas Agricultural Chemicals, Inc., Waynesboro, Georgia. He will serve as president of the company, and Charles F. Daly, president of West Coast Fertilizer Company, Tampa, will be vice president of Atlas. Plant facilities are operated by Atlas for the manufacture of consumer formulations of agricultural insecticides, fungicides and herbicides from technical materials. Grinding, impregnating and blending facilities are maintained. Atlas materials will be marketed in Southern and Eastern United States through dealers and distributors.

Before joining Diamond Alkali Company, Mr. Fuchs was manager of the insecticide division of Naco Fertilizer Company, Charleston, S. C.

•

Nat'l Potash Appoints Tayloe

Richard D. Tayloe joined National Potash Co. April 1 as director of technical services. In his new position he will assist fertilizer manufacturers with formulation and other production problems. Prior to joining National Potash he was with Davison Chemical Co., Baltimore, as supervisor of process and quality control of the fertilizer department.

•

Am. Potash Plans New Offices

American Potash & Chemical Corp. announced recently plans to set up district sales offices in San Francisco and Portland, Ore., augmenting the company's western states sales activities. The San Francisco office will handle sales in northern and central California, Nevada, Utah and Colorado. Oregon, Idaho, Washington, Montana, Wyoming and British Columbia will be under the Portland office.

•

Antara Reduces Prices

Antara Chemicals, a sales division of General Aniline & Film Corp., New York, last month announced new reduced prices on acetylene chemicals being produced at the company's new commercial plant in Calvert City, Ky. Reduced prices follow closely the announcement that the new installation has gone on stream.

West End, Stauffer To Merge

West End Chemical Co. and Stauffer Chemical Co. announced last month that representatives of their boards of directors are discussing a proposal for merging West End with Stauffer. Under the terms of the proposal it is contemplated that West End will continue to operate under its present management as an autonomous division of Stauffer.

•

Wilson on Food-Drug Comm.

Louis H. Kilson, secretary and director of information of the National Plant Food Institute, Washington, D. C., has been named director of agricultural public relations of the 50th anniversary committee in connection with the celebration of the 50th anniversary of the Federal Food, Drug and Cosmetic Laws.

•

Geigy Moving to Westchester

Geigy Chemical Corp., whose offices have been located at 89 Barclay St., New York City since soon after the turn of the century, will be moving in early summer to a new building of their own now under construction on Sawmill River Road, Ardsley, Westchester County, N. Y. Located on a 35 acre tract, the quarters now being built to house Geigy offices and laboratories will occupy over 130,000 square feet and 400 people will be employed.

Geigy Chemical Corp. is the American affiliate of a Swiss firm. Five main divisions are operated: Geigy Agricultural Chemicals; Geigy Patent Licensing and Services; Geigy Pharmaceuticals; Geigy Industrial Chemicals and Geigy Dyestuffs.

Mississippi River Fuel Corp. Opens Ammonium Nitrate Plant

The new ammonium nitrate plant of the Mississippi River Fuel Corp., Selma, Mo., went into production recently with an inaugural run on its battery of new Bemis fertilizer packers. Present at the opening ceremonies: l. to r., John L. Sanders, sales manager; Cecil H. Lashlee, plant manager and Bemis representatives O. W. Whitehead and A. J. Grunzinger.

THE TREND IS TO dieldrin:

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IM&CC Appoints Roughton

The Potash Division, International Minerals & Chemical Corp., Chicago, announced recently that Roy Roughton has been appointed sales representative for agricultural potash salts in the Chicago district . He will be responsible for agricultural sales of the division throughout the west northcentral area of the Midwest.

•

Kingsbury Granulation Plant

Kingsbury Co., Peru, Indiana, recently displayed its new granulation equipment at an open house attracting almost a hundred industry men and guests. The new equipment was installed late in 1955 and consists of a 7′ x 10′ ammoniator, an 8′ x 40′ rotary dryer, a 7′ x 40′ dryer, and corresponding cyclone dust collectors, fans, screens, cage mills and conveying equipment. The plant has a capacity of 40 tons per hour of granulated fertilizers.

Also featured at the gathering was a review of the "Agricultural Outlook," presented by O. M. Ray, of the department of agricultural economics at Purdue University.

Officers of Kingsbury & Co., which is celebrating its 60th anniversary this year are: G. H. Kingsbury, president; E. D. Kingsbury, vice president; J. L. Schell, secretary-treasurer; and L. Mark Henderson, assistant treasurer.

•

Thimet for Cotton Plants

The systemic insecticide "Thimet" produced by American Cyanamid Co., New York, has been accepted by the USDA, and is suggested for early season control of cotton pests. The product is in limited commercial production, will be marketed in 1956 to seed treaters in Mississippi and Texas only, and by 1957 will be distributed throughout all cotton growing areas in the United States and several foreign countries.

A full report on this insecticide appears on page 67 of the January issue of *Agricultural Chemicals*. Elsewhere in the January issue of Ag Chem, the product was incorrectly referred to as "thimus." Some question has also risen on the chemical composition which has been verified as O,o-diethyl S-(ethyl thiomethyl) phosphoro dithioate.

•

Haslanger Named Vice Pres.

Robert U. Haslanger has been elected vice president and general manager of Escambia Bay Chemical Corp., it was announced recently.

For a number of years Mr. Haslanger was with Monsanto Chemical Co. where he held various posts in research, product development. and sales. More recently he was with Stauffer Chemical Co. as assistant to the president and director of sales, Industrial Chemicals.

•

Fertilizer Plant Planned

J. Albert Hopkins, president, Arkansas Farmers Union, advised recently that the National Farmers Union has definitely agreed to build a multi-million-dollar fertilizer and agricultural plant in Arkansas. The decision was agreed upon at a board of directors meeting in Denver.

Diamond Appoints Taylor

Clyde C. Taylor has been appointed assistant plant manager of the Richmond, Va., plant of Diamond Black Leaf Co. For the past two months Taylor has been a staff assistant at the firm's national headquarters in Cleveland.

•

Calspray French Corp. Change

California Spray-Chemical Corp., Richmond, Cal., announced March 24th a change in the corporate structure of its French subsidiary, California-Spray Chemical Cie. Francaise S.A.R.L. Co., France. The firm will be converted into a "Societe Anonime" with capital totaling 265 million francs.

N. B. Van Buren, former president of Calspray's French subsidiary, has been named president and director general of the new French organization. At the same time, Mr. Van Buren was named general manager, eastern hemisphere operations, for the French parent company.

Bulk Chemical Sales Conference

At a recent bulk chemical sales conference held at Furnace Creek Inn, Death Valley, Cal., Pacific Coast Borax Co. revealed its future expansion plans to members of the company's industrial, plant food and agricultural sales divisions. Details of the company's new open-pit mining operations and expanded processing plant now under construction at Boron, Cal., were explained.

Shown for the first time was the company's new motion picture, "The Modern Way to Weed Control." Sales personnel from the U.S. and Canada, representing the company's bulk divisions, were in attendance. Among those addressing the group were N. C. Pearson, director, Borax Consolidated, Ltd., London; J. M. Gerstley, president and general manager, Pacific Coast Borax Co. and J. F. Corkill, vice president in charge of sales.

C. S. C.
Poster Program
Expanded

To hasten build-up of package identification in selected farming areas, Commercial Solvents Corp. is expanding its outdoor poster program (photo) for its "2-Step Action" ammonium nitrate fertilizer throughout the pre-planting season. Radio and farm journals round out the campaign, which has been prepared by Fuller & Smith & Ross, New York.

WACA Schedules Conference

The Western Agricultural Chemicals Association will sponsor a special conference at the Clark Hotel, Los Angeles, May 15th. The program for the meeting will be built around the theme "The Experimental Status of New Pesticides." Al Boyce and his group of entomologists, chemists and biologists from University of California will conduct the program, giving answers to typical questions which have been raised concerning the experimental status of the new pesticides in light of the new requirements posed by passage of the Miller Bill.

Plant For Pyrethrum Extraction

Plans for erection of a pyrethrum-extraction plant in Nakuru, Kenya, Africa, have been presented to U. S. and European manufacturers of equipment, it was announced March 26 by African Pyrethrum Development, Inc., New York.

Capacity of the plant is expected to be 2,500 to 3,000 tons of flowers a year, which according to African Pyrethrum, Inc., is substantially the total amount of blossoms now shipped in bales to the U. S. for extraction here. The only other extraction plant operating in Africa is the one at Nairobi with a capacity of 2,000 tons a year.

Cotton Council Features Panels

A panel dealing with progress and problems in controlling cotton diseases was featuured at the opening session of the Western Cotton Production Conference of the National Cotton Council of America in Fresno, Cal., March 6-7. The panel discussed seedling diseases, nematodes, verticillium wilt and boll rots.

Other panels and symposiums conducted included: a progress report on weed control studies in Arizona, California, West Texas and New Mexico; developments in cotton insect control, new insecticides, insect resistance and insect control; problems and recommendations in controlling cotton insects in Texas, New Mexico, Arizona and California.

•

Fertilizer Center Opened

Charles T. Longaker, director of fertilizer sales, announced recently the opening of Ozark Mahoning Co.'s new fertilizer distributing center at Claremore, Okla. Olen Downing will be in charge of distribution.

A complete line of high-analysis mixed and straight fertilizers is available through the new distribution center and is offered bagged, in trucks, and in box or hopper cars.

Photos taken at the Midwest Soil Improvement Committee Conference

(1) C. R. Rex, Woodville Lime Prod. Co.; H. H. Tucker, Sohio Chem. Co., and W. H. Pierre, Iowa State College.

(2) J. W. Hicks and John Zigler, Interna'l Min. & Chem. Co.

(3) Bob Mason, Arkell & Smith; Ben Emkes and Chas. Everhart, Buhner Fert. Co., and Tom L. Jones, Arkell & Smith.

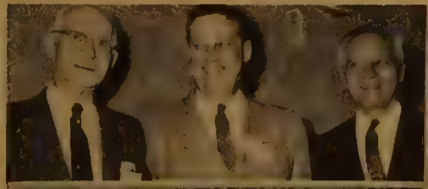
(4) D. G. Hanway, U. of Nebr.; John Hanway, Iowa State; M. D. Weldon, U. of Nebr. and Floyd Smith, Kansas State.

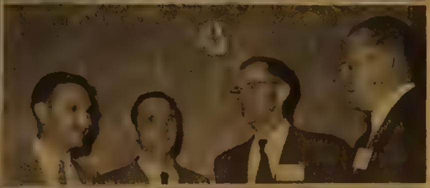
(5) B. M. Machen, Lion Oil Co.; J. L. Naftel, Pacific Coast Borax Co.; H. B. Mann, Am. Potash Institute and Z. H. Beers, MWSIC.

(6) T. E. Bradley, Potash Co. of Am.; A. H. Fahrenkrog, Ill. Farm Supply and C. Lawton, Am. Potash & Chem. Co.

(7) Leo F. Puhr, So. Dak. State College; Malcolm McVickar, Nat'l. Plant Food Inst.; J. C. Zubriski and B. L. Brage, So. Dak. State College and Leonard L. Schrader, Standard Oil Co.

(8) G. O. Powell, Royster Guano Co. and Rob't. Fitzgerald, Smith-Douglass Co.





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Farbenfabriken Bayer and Pittsburgh Coke Pool Agricultural Chemical Resources . . . . Merge Their Interests in Chemagro Corp.

FARBENFABRIKEN Bayer A. G., Leverkusen, Germany and Pittsburgh Coke & Chemical Company, Pittsburgh, in late March announced the consolidation of their respective agricultural chemical activities in the United States and Canada in Chemagro Corporation, New York. Chemagro, through this merger of interests, thus becomes almost unique in the western hemisphere in combining in one company production, research and sales facilities for the sole purpose of serving the agricultural chemicals industry. The new setup will provide Chemagro with its own manufacturing, research and marketing facilities devoted exclusively to the production of agricultural chemicals.

Farbenfabriken Bayer is one of the world's largest and most successful organizations in the development and manufacture of chemical products. The company has a long history of leadership in agricultural chemicals, beginning with the development of the first mercurial seed treatment early in this century. The product is still the leading chemical of its type in the agricultural chemicals industry.

In more recent years, Farbenfabriken Bayer has developed such important pesticide products as Parathion — a versatile and highly effective insecticide; Systox — the first commercially successful systemic insecticide introduced in the United States; and Dipterex — a new fast-acting bait-type fly killer for the control of both resistant and non-resistant flies.

Farbenfabriken Bayer operates four manufacturing plants in Western Germany, and employs approximately 45,000 people, over 500 of whom are research chemists. The company's sales in 1955 totaled almost one and a half billion marks.

Pittsburgh Coke & Chemical entered the agricultural chemicals field in the late 1940's, setting up an Agricultural Chemicals Division with integrated manufacturing facilities at its basic plant at Neville Island, Pa. With a coast to coast sales organization, Pittsburgh herbicides and insecticides were sold through distributors in virtually every state.

The idea of the logical and complementary union of Farbenfabriken Bayer's experienced research and product development facilities with Pittsburgh Coke's well established marketing organization began in 1950 when both companies participated in the establishment of Chemagro Corporation.

Chemagro served to introduce Farbenfabriken Bayer's new agricultural chemical products to the rapidly growing U. S. farm market. Pittsburgh Coke acted as the principal manufacturing source for Chemagro and also marketed several of its products under a licensing agreement.

This limited arrangement proved so successful that the two principal companies agreed early this year to completely consolidate their respective agricultural chemical activities in order to allow Chemagro to operate as an autonomous organization with complete control of its own manufacturing, research and marketing facilities.

George W.Hill, Jr., will continue as president of Chemagro Corporation. Herbert F. Tomasek will serve as vice-president and W. Scott James will be assistant-to-the-president.

Future operations of Chemagro will be directed through four principal departments: Manufacturing, Research, Sales and Accounting.

Director of manufacturing will be Dr. Robert S. Scott, formerly associated with Pittsburgh Coke & Chemical Co. Sites for the company's first manufacturing plant are now under study.

Dr. Rosmarie von Rumker has been appointed director of research. Gordon M. Williams will serve as assistant director of research.

Formerly associated with Farbenfabriken Bayer, Dr. von Rumker is thoroughly familiar with that company's highly developed techniques in research and product development. She has spent the past three years in the U. S. working closely with federal and state agricultural experiment agencies. Pittsburgh Coke's agricultural chemicals research department will be integrated with Chemagro's research facilities.

Chemagro's new sales department will be directed by Hugh H. Swink and B. Thomas Snipes, who will serve as director and associate director, respectively. The former sales organization of Pittsburgh Coke & Chemical's Agricultural Chemicals Division is also being integrated with Chemagro's sales department.

The Accounting Department of Chemagro will be directed by Eric Schopfer. As comptroller, he will direct Chemagro's accounting functions and administer its credit policy.

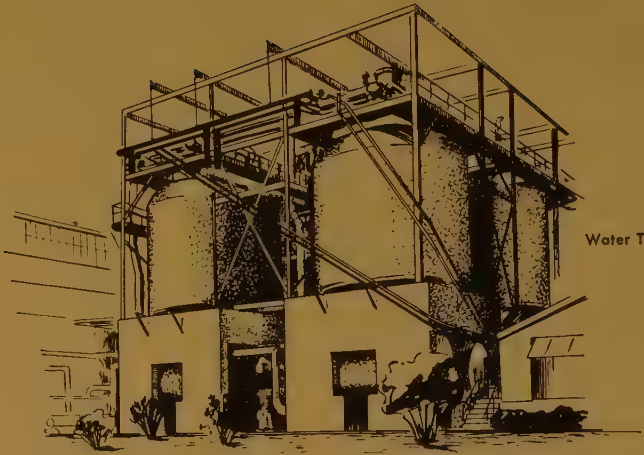
Headquarters for the company will remain at 101 Park Avenue for at least several months, but the organization contemplates moving into larger quarters in central Manhattan later this year.

●

Marietta Adds 4 Silos

The Marietta Concrete Corp., Marietta, Ohio recently finished building four more of its precast concrete stave industrial silos at Lake Charles, Louisiana. These silos, which are 30 feet in diameter and 70 feet in height, are in addition to eight other Marietta silos of the same size which the company erected last year for the Lake Charles Harbor and Terminal Commission.

The eight original Marietta silos are being used for storage of phosphate rock and barytic ore, while similar materials will be held in the four new silos.



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CHEMICAL PROGRESS WEEK-APRIL 23-28

A BETTER AMERICA THROUGH CHEMICAL PROGRESS

APS Elects New Officers at Potomac Division Meeting

RESEARCH successes against plant diseases with five new antibiotics and an antibiotic mixture headlined the 13th annual Potomac Division meeting of the American Phytopathological Society.

More than 50 plant disease specialists from the Middle Atlantic States, who met at the U.S. Department of Agriculture's Plant Industry Station, Beltsville, Md., on March 1-2, heard Dr. W. J. Zaumeyer of USDA tell of his outstanding results with antibiotics against four fungus diseases of beans and lima beans. USDA's W. H. Preston, Jr., reported effective bean rust control with an antibiotic mixture developed by T. G. Pridham and associates at the USDA Northern Utilization Research Laboratory, Peoria, Ill.

Dr. Zaumeyer carried out greenhouse experiments with these antibiotics: Anisomycin, a product of Chas. Pfizer & Co.; Mycostatin, Squibb Institute for Medical Research; Oligomycin, a development of the University of Wisconsin; Griseofulvin, an English discovery being developed with the cooperation of Merck & Co., and Filipin, which was discovered by the University of Illinois and is being developed by Upjohn and Company. All of these antibiotics were effective in controlling at least one of the four fungus diseases against which they were tested, Dr. Zaumeyer said, but Oligomycin showed the widest promise. Sprayed on bean plants prior to disease inoculation, a water suspension containing 100 parts per million of antibiotic prevented infection with rust and anthracnose; on lima beans, it prevented downy mildew and stem anthracnose.

The USDA-developed antibiotic mixture, designated F-17, contains three, and possibly four antibiotics. When the F-17 filtrate was diluted to 1/16th its original concentration and painted on the upper surfaces of leaves, and the disease introduced to the undersides of the same leaves, development of rust was completely prevented. When used without dilution, F-17 prevented rust spore formation when applied four days after the bean plants were inoculated with the disease.

Of the materials tested by Zaumeyer, only one—Anisomycin—demonstrated disease eradication qualities. Plants treated with 200 parts per million of this drug as long as four days after infecting with rust, were freed of disease. As a preventative treatment, Anisomycin protected beans from rust and lima beans from downy mildew. Mycostatin protected beans from anthracnose and provided partial protection against bean rust and downy mildew of lima beans. Griseofulvin protected beans from rust. Filipin partially protected beans from anthracnose and gave effective control of downy mildew of lima beans.

In addition to these notable announcements, indicating that research is greatly broadening the potential of antibiotics against fungus diseases, other meeting highlights included reports on:

An effective fungicide mixture for the control of downy mildew on Atlantic Seaboard and Gulf Coast muskmelons;

A captan-zineb combination spray for the control of sooty blotch and botryosphaeria rot on Eastern-grown apples;

Discovery of several common Delaware oat varieties with resistance to two species of the prevalent root knot nematode;

A helpful nematode that feeds on the fungus that causes fusarium wilt of carnations;

A survey of Maryland soils, which shows the stubby root nematode generally occurring in light sandy soils grown to corn, soybeans, tomatoes, or tobacco;

Identification of two insect carriers of a sweet potato virus disease.

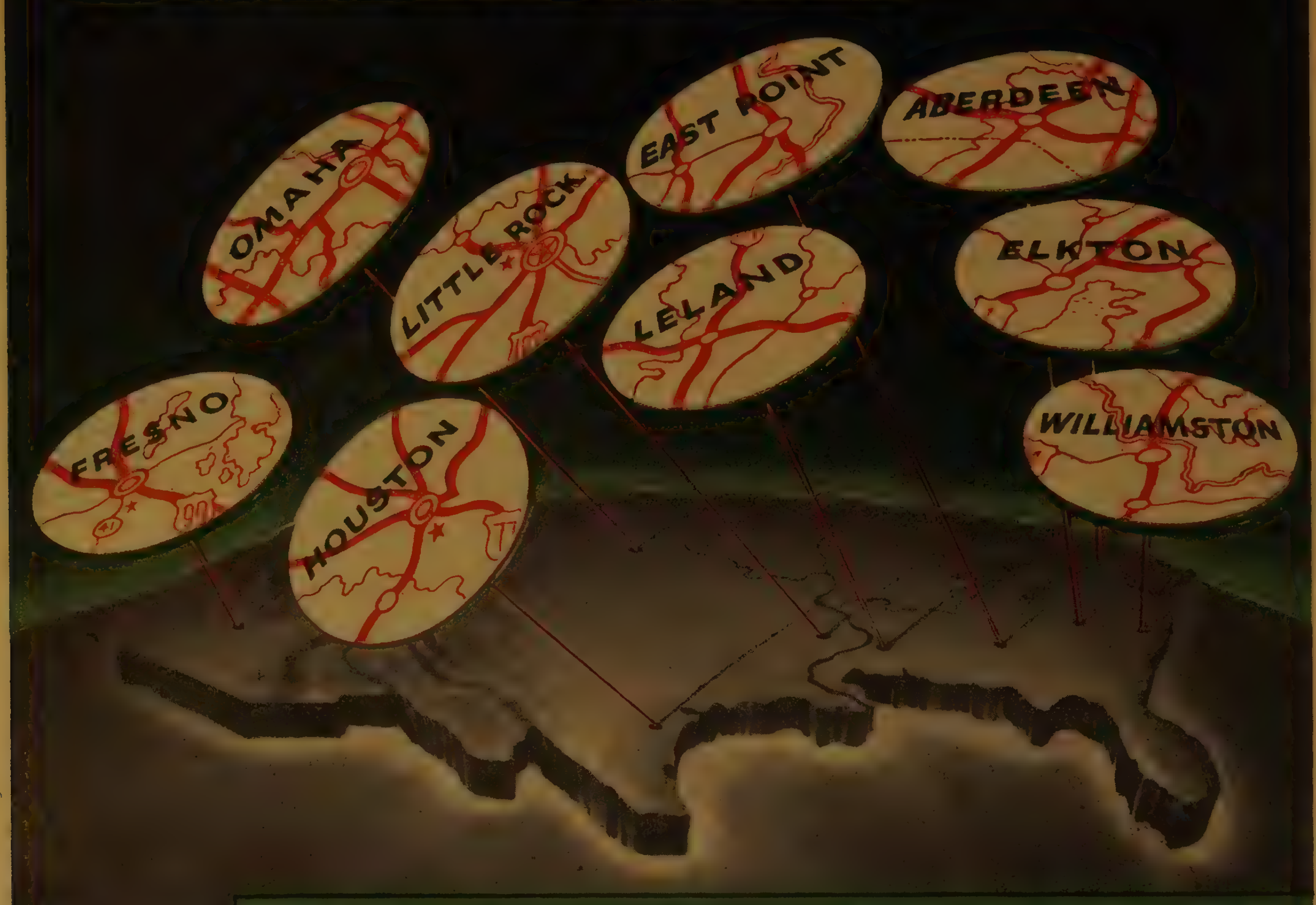
F. S. Beecher of USDA said that extensive field trials had established that a tri-basic copper sulfate-zineb spray mixture provides the most effective protection for muskmelons against downy mildew fungus. Either two pounds or three pounds of tribasic copper sulfate—depending upon the likely severity of downy mildew—should be tank-mixed with two pounds of zineb in 100 gallons of water.

J. W. Heuberger, R. R. Romanko, and M. Q. Sayed of the University of Delaware found a spray mixture containing captan and zineb, each at the rate of three-fourths pound per acre—half strength—provided excellent control of sooty blotch and apple rot. Harvested fruit showed no evidence of chemical burn. In addition, the half-strength schedule kept the residues of these two fungicides well below the legal tolerance.

H. W. Crittenden of the University of Delaware established these oat varieties to exhibit resistance to two important species of root knot nematodes, giving them value as grain crops and as winter cover rotation crops: Arlington, Atlantic, Mustang, Lemont Cross, Coy, Frazier, DeSoto,

New officers elected at the Potomac Division, APS meeting are, l. to r., Dr. J. G. Leach, president, University of West Virginia; Dr. Kermit Kreitlow, vice president, U. S. Department of Agriculture, Beltsville, Md.; Dr. L. O. Weaver, secretary treasurer, University of Maryland and Dr. W. D. McClellan, USDA.

from MATHIESON to CUSTOMER—



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CHEMICAL
PROGRESS
WEEK-APRIL 23-28

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Victorgrain, and Victoria. Susceptible oat varieties included: Forkedeer, Lee, Letoria, Stanton. Traveler, Fulwin. Arkwin, Leconte, and Dubois.

A. F. Schindler and Robert N. Stewart of USDA found that certain species of the Ditylenchus nematode—commonly called the mushroom spawn nematode—when added to the potting soil of carnations, sharply reduced plant infection with fusarium wilt fungus. Carnations treated with the nematodes showed no disease symptoms 17 days after infection with the wilt.

R. A. Rohde and W. R. Jenkins of the University of Maryland examined a thousand samples of Maryland soils; found the stubby root nematode in 45 of them, all of a light, sandy nature. Greenhouse experiments showed these nematodes capable of attacking nearly all important commercial crop plants, indicating that their control through crop rotation would be generally impractical. Studied on tomatoes, this nematode caused stunting of plants and malformation of lateral roots.

E. M. Hildebrand and Floyd F. Smith of USDA have established the aphids *Myzus persicae* and *Macrosephun solanifolii*, the green peach aphid and the potato aphid, as carriers of a sweet potato virus. Their greenhouse studies demonstrated that the green peach aphid could transmit this disease from sweet potato to sweet potato, from sweet potato to morning glory, and from morning glory to sweet potato. The other aphid was capable of transmitting the virus from sweet potato to sweet potato.★★

•

Egypt Plans Fertilizer Plant

The Egyptian National Production Council announced recently that a huge $63.3 million nitric fertilizer factory will be built near the site of the Aswan Dam in a drive to expand the industrialization of this basically agricultural country.

A German-French group, Uhde, Badische-Anilin & Schneider, will construct the plant. A Council spokesman said maximum production will be 1280 tons per day. Operations are expected to begin in 1959.

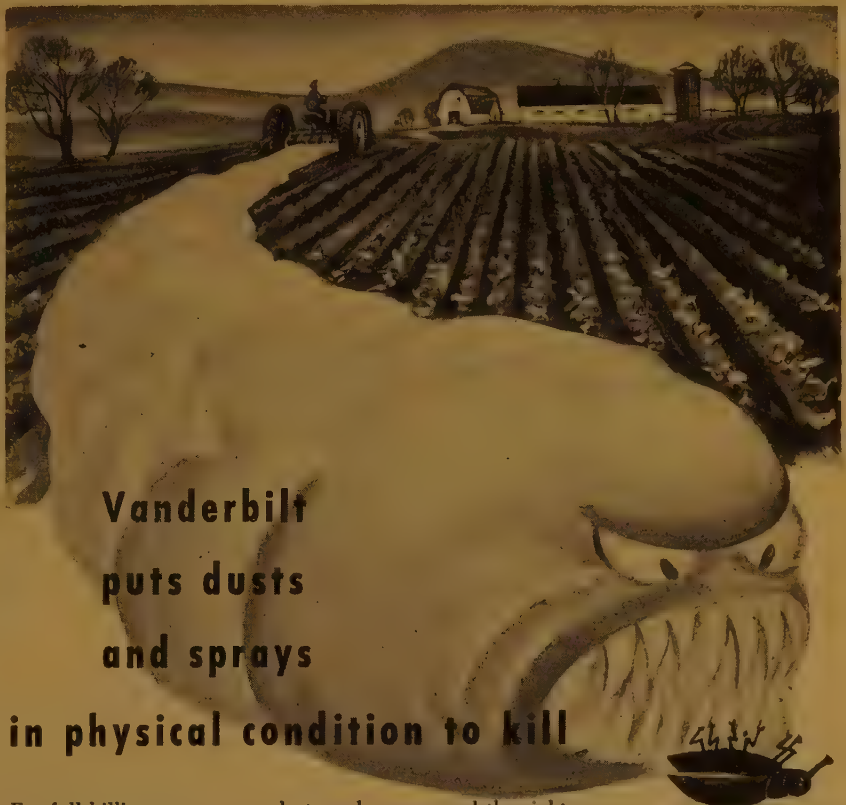
Raymond Now a Corporation

Announcement of the formation of the Raymond Bag Corporation, division of Albemarle Paper Manufacturing Co., was made recently by F. D. Gottwald, Albemarle president. The new corporation combines the manufacturing facilities of the Raymond Bag Co., Middletown, Ohio, with those of the Multiwall Bag Division of Albemarle, Richmond, Va. Paper for both operations will be supplied by Albemarle's two Richmond paper mills and its Halifax paper division, Roanoke Rapids, N. C. General offices for the new corporation will be in Middletown.

•

Nitrogen Div. to Build

Nitrogen Division of Allied Chemical & Dye Corp. are preparing to build a solid ammonium nitrate plant at Hopewell, Va., to cost in excess of a million dollars. Construction will get under way shortly and it should be completed and in production by the end of the year.



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U.S. Potash Names McBride

Alexander McBride joined U.S. Potash Co., New York, as a sales representative March 26. He will work with W. Wilson in the firm's midwestern territory. Mr. McBride has served as a sales representative with the Springfield Fire and Marine Insurance Co. and with the Dragon Cement Co.

ACS Nat'l Meeting April 8-13

The 129th national meeting of the American Chemical Society will be held April 8-13 in Dallas, Texas. J. C. Warner, president, ACS, will preside at the general meeting April 9 at Hotel Statler Hilton. At the agricultural and food chemistry divisional meeting the following talks will be included: "A Simplified Bioassay for Insecticide Residues," L. C. Terriere and Ulo Kiigemagi; "TDE and Endrin Residues on Tobacco," Thomas G. Bowery, Robert L. Rabb, Frank E. Guthrie and Robert J. Monroe; "Opinion on Residues," Thomas H. Harris and "Requirements of Analytical Data Supporting Pesticide Residue Tolerances," Frank A. Vorhes, Jr.

George A. N. King Succumbs

George A. N. King, one of the founders of McLaughlin Gormley King Co., Minneapolis, died March 5. He had been engaged in company activities for more than 50 years. At the time of his death he was secretary and a member of the board of directors for the firm.

Mr. King is survived by his wife and two sons, Allen S. and George S. King. A third son, the late Harold R. King, was president of R. J. Prentiss & Company, New York.

Tarleton Ag Chem Conf. Held

Speakers at the first Tarleton Agricultural Chemical Conference, held recently in Stephenville, Tex., told farmers that fertilizers will pay off on some crops, that insecticides will be worth the money if conditions warrant their use and that brush can be controlled through use of chemicals. Sponsoring the conference were Tarleton State College, the Texas A&M System and Stephenville and West Texas Chambers of Commerce.

ESA N. Cent. Branch to Meet

The 11th annual conference, North Central Branch, Entomological Society of America, was scheduled to be held March 28-30 at Purdue University, West Lafayette, Ind. Opening remarks were to be given by B. A. Porter, ESA president; Ralph E. Heal, L. M. Black, James Beal and Roger C. Smith.

Sectional meetings were to discuss: Medical and Veterinary Entomology, Fruit Insects, Forest and Ornamental Insects, Truck Crop Insects, Vectors of Plant Diseases and Ecology and Bionomics.

A tour of the Purdue Entomology Department was scheduled.

Allied Chem. Combines Offices

Allied Chemical & Dye Corp. announced recently the consolidation of its eight San Francisco sales offices with new quarters in the Russ Bldg. The following divisions have consolidated their sales offices: Barrett, General Chemical, National Aniline, Nitrogen, Solvay Process, Semet-Solvay, Mutual Chemical and International.

Four Appointed By Fulton

Four appointments to the recently created general office, Bag Division, Fulton Bag & Cotton Mills, New Orleans, were announced last month. They include W. W. Plumb, Atlanta, director of manufacturing; J. A. Banda, Atlanta, director of export sales; F. C. Sivori, New Orleans, director of canvas sales and H. H. Rogers, Atlanta, who will be in charge of industrial engineering.

Mr. Plumb was chief engineer before receiving his new appointment. Mr. Banda has been connected with the company's export activities since joining Fulton. Mr. Sivori was manager of the New Orleans canvas and pick sack department prior to being named to his new post and Mr. Rogers headed the company's industrial engineering department for the past 11 years.

New Velsicol District Mgr.

M. L. Anderson, Velsicol sales representative in Texas, New Mexico and Oklahoma for the past four years, has been appointed Southwest district manager for Velsicol's Agricultural Chemicals Division. He will headquarter at Austin, Texas. Before joining Velsicol Mr. Anderson was manager of aerosol sales for the Virginia Smelting Co.

Dow Buys Ten Patents

Dow Chemical Co., Midland, Mich., purchased a number of patents recently, which claim certain herbicidal compositions resistant to freezing and crystallization at low temperatures. The patents involved, Nos. 2,721,124 through 2,721,133, issued in the name of John C. R. Warren, were formerly owned by the U.S. Rubber Co.

Under the patents, Dow markets herbicidal formulations containing mixtures of several ester compounds of 2,4 dichlorophenoxyacetic acid (2,4-D) and 2,4,5 trichlorophenoxyacetic acid (2,4,5-T) as active ingredients.

Three Dow products that fall within the scope of the newly purchased patents are butyl 2,4 dichlorophenoxyacetate, brush killer 50-50 and Esteron 76E. Two others, Dow Butyl 265 and Dow Butyl 400, will appear on the market soon.

Stauffer Reports Record Sales

Both sales and earnings of Stauffer Chemical Co., New York, last year were the highest in the firm's 70 year history, according to the company's annual report which was released to stockholders last month. The 1955 business volume was 22 per cent higher than 1954. Net income after taxes was $12,299,000.

Thayer Appoints Jackson

Thayer Scale & Engineering Corp., Rockland, Mass., announced the appointment of Ralph Jackson last month as district sales manager, covering the north central states. Mr. Jackson will establish a new district office in St. Paul, Minn. He was formerly with Bemis Packaging Service division.

Calspray Mgr. On Tour

M. E. Wierenga, manager, foreign department, California Spray-Chemical Corp., Richmond, Cal., left recently on an extended survey of Calspray merchandising and advertising programs in Mexico and Central America. During the latter part of his trip he will be accompanied by R. B. Auer, Calspray's manager of foreign sales for the Western Hemisphere and the Orient.

•

Union Names Patterson, Bess

Union Bag & Paper Corp., New York, announced last month the appointment of J. J. Patterson Jr. as director of multiwall bag sales. A member of the organization since 1936, Mr. Patterson has been associated with the multiwall bag division since its inception.

The company also announced appointment of William T. Bess Jr. as assistant director of multiwall bag sales. Mr. Bess joined the company in 1950 and served most recently as southeastern district manager of the multiwall bag sales division.

•

Dr. Horsfall Begins Global Tour

Dr. James G. Horsfall, director, Connecticut Agricultural Experiment Station, left for New Zealand March 29 to consult with growers and scientists, at the invitation of the New Zealand Fruitgrowers Federation, Ltd.

On his return trip Dr. Horsfall will visit Australia, India, Austria, Germany, Italy and Holland where he has been invited to lecture.

•

Vulcan Appoints Fahey

Gerald J. Fahey has been named sales representative for Vulcan Containers Inc., Bellwood, Ill., it was announced recently. He will represent Vulcan in the greater Detroit area. Mr. Fahey was formerly with Minnesota Mining and Manufacturing Co., Detroit Adhesives and Coatings division, as purchasing agent.

•

New Ammonia Plant

Plans for construction of an estimated $12,500,000 petrochemical plant at Lake Charles, La., to produce anhydrous ammonia for use primarily as a fertilizer, were announced last month by Petroleum Chemicals, Inc., which is jointly owned by Continental Oil Co. and Cities Service Co.

F. M. Simpson, vice president and general manager of Petroleum, said the plant will produce 100,000 tons of ammonia annually. Completion is scheduled for the fall of 1957. The ammonia will be marketed by Mid-South Chemical Corp., Memphis, which is also jointly owned by Continental and Cities Service.

NSC Sponsors Contest

The fertilizer section, National Safety Council, is sponsoring a nationwide "Picture of Safety Contest," designed to uncover good ideas, already in practice, which have improved safety in fertilizer plants. The contest, which began April 1, is scheduled to end June 30.

All entries are to be mailed to J. C. Kato, fertilizer section, National Safety Council, 425 North Michigan Ave., Chicago 11, Illinois.

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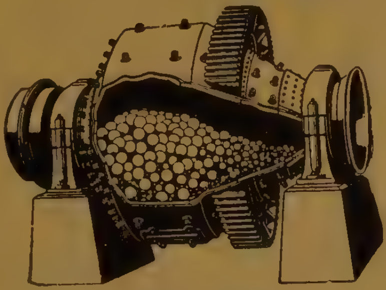
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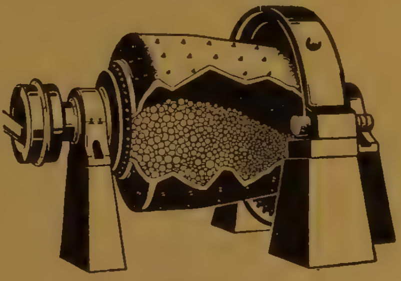
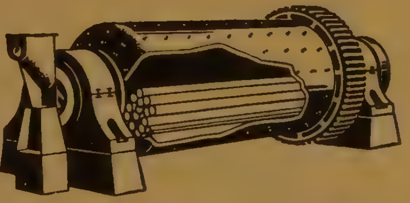
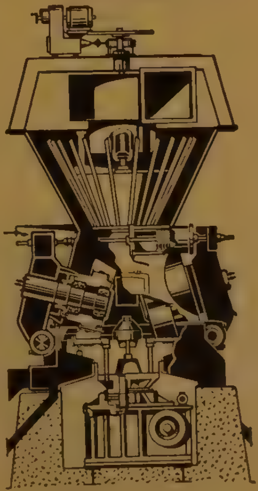

TRICONE MILLS

TUBE MILLS


ROD MILLS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WRITE FOR INFORMATION — Dept. 57

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Corrosion, Loading Obstacles Offset In New British Crop Dusting Planes

THE first aircraft designed specifically for agricultural crop dusting and spraying have been produced almost simultaneously by two British aircraft manufacturers. They are the Percival P.9, a high wing monoplane, and the Auster Agricola, a low wing monoplane. The Percival will be on the U.S. market shortly, but the Auster Agricola will not be available here for the present.

The flying trials of both planes, now in progress, mark the climax of a race which began two years ago when the New Zealand Government appealed to the United Kingdom aircraft makers to produce specialized machines for its aerial top-dressing campaign. The aerial fertilizing program is expected to increase New Zealand's meat production by 50 per cent within the next ten years. Top-dressing of the country's alpine pastures has already more than justified itself by the amazing increase effected in stocking with sheep and cattle. An increasing number of farmers today regard an air-strip on their property as essential.

The Percival P.9 (left) used for spraying or dusting, will soon be on the U. S. market. The Auster Agricola (right) has been designed specifically for topdressing operations in New Zealand.

Main Plane Operations

VERSATILITY in both planes is a must since the main types of operations needed in New Zealand include: fertilizer top-dressing, crop spraying with insecticides and weed-killers, forest surveying, dusting, sowing pelleted seed and fertilizer, anti-locust campaigns, sowing rice, transporting agricultural needs, sheep, calves and carcass meat, wool and even shearing gangs.

When Edgar Percival inspected the country prior to his designing the P.9, he found other requirements had to be filled, such as having enough storage room in the plane to carry supplies to deer shooters (who are constantly employed in the mountain areas to destroy the large herds of wild deer). He also found that fenceposts and fencing material had to be carried by plane to the mountains. He completed the P.9 in about 20 months after investigating all the New Zealand problems. The plane has a 270 horsepower engine and a gross weight of only 3,675 lbs., giving a fertilizer load of 1,550 lbs. When fitted with a hopper or an alternate spray tank, a ground crew of three, plus a pilot, can still be carried.

The hopper compartment of the P.9 can be used for fertilizer or equipment carrying. It is large enough for three men to stand upright.

The unorthodox design of the P.9 hopper compartment, large enough for three men to stand upright in it, permits clam doors at the rear, opening below the fuselage. This means that such farm requirements as fencing posts and wire, wool bales or small livestock can easily be slid in from the low loading level.

Corrosion Problems Combated

TOP-DRESSING with fertilizer brings considerable problems. Superphosphate, for instance, if allowed to become moist, causes corrosion. It can rapidly eat through lapped joints and rivets and flying control wires. It may penetrate the cockpit and affect the instruments, but the safety measures provided in both planes eliminate most of the danger. Each outer wing in the Auster Agricola is a completely sealed unit to prevent the ingress of superphosphate. Special plastic dopes and paints on the fabric-covered fuselage and wings guard against corrosion. Control cables are nylon covered. The pilot sits above and behind the engine and fertilizer hopper, which seals his cockpit from any drifting fertilizer.

In the P.9 the high wings, covered in light alloy skin, are well out of reach of the fertilizer and fuselage is treated with anti-corrosion dope.

Fertilizer Capacity

LONG before the Agricola first flew, tests were carried out with various types of hopper designs to determine the most efficient shape.

one of the Geigy "Big 4"

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GEIGY METHOXYCHLOR is a low-cost, residual "general purpose" insecticide ideal for control of plum curculio, grape berry moth, cucumber beetle, leafhoppers, and many other insects attacking fruit, vegetables and forage crops. Residual sprays applied to empty grain bins are effective in controlling many insect pests of stored grain. Direct applications to livestock are effective in controlling horn flies, lice and ticks.

GEIGY METHOXYCHLOR is ideal for aerosol and spray formulations. It has low toxicity to man and animals and long residual toxicity to insects. It is compatible with pyrethrins, allethrin, and piperonyl butoxide.

GEIGY METHOXYCHLOR is available as:

- *GEIGY METHOXYCHLOR "90". A concentrated* METHOXYCHLOR *product for use in the formulation of* METHOXYCHLOR *sprays and aerosol solutions.*
- *GEIGY METHOXYCHLOR "20". For use in preparation of household sprays, dairy barn sprays, aerosols, and other products where small amounts of* METHOXYCHLOR *are desired in finished products.*
- *GEIGY METHOXYCHLOR "25E". A 25% emulsifiable solution for use in sprays.*
- *GEIGY METHOXYCHLOR "50". A 50% wettable powder and dust base especially useful for direct applications to livestock.*

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Safe, effective miticide for control of various species of mites on apples, pears, azaleas, holly, spruce, and other ornamental and agricultural crops. Long residual action. Relatively non-toxic to bees.

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The original metal chelates in the field of agriculture. Completely water soluble, compatible with fertilizers and most pesticides. Designed for the correction of iron deficiency (chlorosis) in ornamentals, fruit trees, vegetables, and turf.

*"SEQUESTRENE" is the brand name for metal chelates sold by Geigy Agricultural Chemicals, Division of Geigy Chemical Corporation

ORIGINATORS OF Geigy DDT INSECTICIDES

GEIGY AGRICULTURAL CHEMICALS Division of Geigy Chemical Corporation **89 BARCLAY STREET, NEW YORK 8, N. Y.**

Dropping tests were made from these hoppers fitted in other planes.

Of ¾ ton (1,680 lbs.) capacity, the hopper is set well below the pilot to afford him ample protection in the event of a crash. It is filled through an 18″ diameter filling trunk positioned behind the cockpit. To resist both chemicals and abrasion, the interior of the hopper is faced with stainless steel. Operation of the hopper discharge doors is by two hydraulic jacks controlled by a small lever. When fully open, the hopper doors allow 8″ lumps of superphosphate to fall free.

Though no price has yet been fixed for these two new models, it is believed that they will sell in Britain at about $15,400 each.

•

Am. Cyan. Boosts NH_3 Output

Manufacturing capacity for two major products is being increased at the Welland Plant, North American Cyanamid Ltd., Niagara Falls, Ont., according to G. L. Berry, plant manager.

Facilities for the production of Cyanamid's "amanol" nitrogen solutions used as agricultural fertilizers, will be doubled this year, Mr. Berry said. In addition, equipment for manufacturing anhydrous ammonia will be modified to achieve greater capacity.

•

Ballman Cited by Association

Donald K. Ballman, general sales manager, Dow Chemical Co., Midland, Mich., was recipient of the 1956 honor award of the Commercial Chemical Development Association March 9.

Mr. Ballman was cited for pioneering work, leadership and accomplishment in product development in the fields of plastics, agricultural and industrial chemicals.

•

Dow Opens $1,100,000 Lab

Dow Chemical Co., Midland, Mich., officially opened a new $1,100,000 laboratory building, March 7, for research in biochemistry.

The main objective of the research plant is protection of the public and of persons working with chemicals. Basic research will deal with the chemistry of living things and specific research will attempt to develop new and useful chemical products.

•

CSC Appoints Brook in Canada

Commercial Solvents Corp., New York, announced March 17 the election of T. L. Brook, Calgary, Alta., as president of Northwest Nitro-Chemicals Ltd. at Medicine Hat, Alta. At the same time Mr. Brook announced the appointment of Clarence W. Hancock as general manager of Northwest. Mr. Hancock has served as plant startup co-ordinator at CSC's Sterlington, La. and Terre Haute, Ind. plants.

Northwest is an affiliated company of CSC and will be operated under a long-term management contract. The $22 million plant, now under construction and scheduled for completion in October, will produce ammonium phosphate and nitrate fertilizers. Contracts have been completed by Northwest for the supply of phosphate rock and sulfur.

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Weed, Disease, Pest Control Problems Highlight 11th Shade Tree Conference

By H. H. Slawson

DUTCH elm disease, which is destroying thousands of trees in the midwest, received special attention on the program of the 11th annual meeting of the Midwest Chapter, National Shade Tree Conference, in Chicago, Feb. 22-24. Other insect problems of the arborist, herbicide drift and liquid fertilizers for tree feeding were among other topics involving agricultural chemicals discussed at the Lasalle Hotel meeting.

Registration of nearly 400 from the Chapter's 12-state area was the largest on record. The group included professional arborists, municipal tree care officials, landscape architects, nurserymen and state college research authorities.

At the business session Charles Warren, city forester of Omaha, Nebr., was elected president for the coming year. Frank J. Pipal, a commercial consulting forester, also of Omaha, was chosen vice president and Noel Wysong, chief forester, Cook County Forest Preserves, Chicago, was re-elected secretary-treasurer.

Among figures submitted by various speakers, suggesting the serious proportions of the Dutch elm disease epidemic in the midwest, Illinois spokesmen reported that from one infected tree discovered in Mattoon, Ill., in 1950, the plague has spread to over 5,000 trees in 74 Illinois counties. In Cook county, surrounding Chicago, and in four adjacent counties, there were 11 known cases in 1954, while last year the figure rose to 150. In the Champaign-Urbana area, home of the Univ. of Illinois, 39 percent of the elm trees have fallen victims to the disease. Throughout Michigan the disease has been diagnosed in 5,745 trees and the city of Detroit, which in 1950 had 9 cases, has appropriated $330,000 to pay for control measures this year.

E. F. Herrbach, horticulturist with Standard Oil Co., Chicago, created a mild sensation, when, in a talk on spraying to control the elm bark beetle, vector of Dutch elm disease, he asserted that municipalities are not giving sufficient attention to proper and adequate spray programs. When such programs are instituted, he said, the citizens become wildly enthusiastic in their belief that their progressive community is getting everything under control.

Actually, Mr. Herrbach said, the spraying crews are often not doing a good spraying job. He told of instances he had observed where the equipment could not lift the spray stream more than half way up a 50-foot tree. Often, too, he said, the wind would carry the spray away before it reached the tree. One 2-man crew he watched never left their truck, with one of them directing a hose through the cab window, while the other shot his stream from a sitting position on the tail board.

Spraying to kill the elm bark beetle, Mr. Herrbach emphasized, is entirely different from spraying for scale and other tree insects. The tree should get a 100 percent coverage with an adequate amount of spray or the effort is wasted, he declared. He suggested close supervision of the spraying operation as a "must" in every community.

Communities which think they can save a bit by buying the ingredients and mixing their own DDT emulsion could be making a serious mistake, Mr. Herrbach warned. Many proprietary products are available that are properly formulated, he pointed out, and their cost is only slightly above that of home-made emulsions.

"You're fooling with an unknown quantity," he declared, "if you change the manufacturer's recommendations. That will jeopardize the whole control program."

He also took issue with charges that DDT sprays damage elm trees. As many as 30 sprays have been applied to one tree without harm to it, he stated. He admitted that spray treatments are expensive. "But it's more expensive," he added, "to remove the dead tree; and, besides, you end up with no tree at all."

Authorities are recognizing that it is physically impossible to locate and eradicate every diseased elm tree, said Dr. Richard J. Campana, assistant plant pathologist, Illinois Natural History Survey, Urbana, Ill. The disease incubates sometimes for two years before its identifying symptoms appear, he explained. If this had been known earlier, the control program to date might have been more successful. No known means for killing the disease fungus is available, so an intensified spray program concentrated on the elm bark beetle, is thus in order, he asserted.

It has been adequately demonstrated, the Illinois scientist said, that sanitation can accomplish a great deal in preventing spread of the disease. But sanitation alone, he stressed, is not the whole answer to any control program. "Remember," Dr. Campana emphasized, "it is not the fungus against which action should be taken, it's the beetle. They are the principal factor in spread of Dutch elm disease, so we must get the beetle by adequate spraying operations."

Michigan's "do it ourselves" program for control of Dutch elm disease and other insect problems of the Wolverine state were described by G. A. Boyer, chief, bureau of plant industry, state dept. of agriculture, Lansing, Mich. In 1953, Mr. Boyer said, the state legislature appropriated $10,000 for Dutch elm disease control work. This was increased to $75,000 for the current year but the Detroit city council's appropriation of $330,000 he cited as a supreme example of how a community can accept responsibility for its own welfare and pitch in wholeheartedly on a cooperative program.

From Oak Park, Ill., a Chicago suburb, came another account of community action against the disease which is threatening this town's 28,000 trees, estimated as worth "millions of dollars."

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When the first case was discovered in 1954, said Thomas F. Greeley, Jr., village forester, Oak Park didn't have a forester, not even a pruning crew and no equipment was available for the work to be done. He told how, after his appointment, he immediately engaged a professional tree care organization to get busy on saving the trees until municipal crews could be organized and trained. Mist blowers and other equipment were purchased and put to work, and the situation has been improving. As of the day he spoke at the Chicago meeting, six trees a day were being taken down and their stumps removed.

In a talk on "Insect Problems of the Arborist," Dr. Donald L. Schuder, assistant entomologist, Purdue Univ., Lafayette, Ind., forecast a heavy infestation of "17-year locusts" in the midwest. Known more accurately as the "periodic cicada," he said this pest will be especially prevalent this season across northern Indiana, northern Illinois, southern Wisconsin and eastern Iowa. While forest trees are not seriously damaged, this pest is a serious threat to nurserymen, he warned, due to its habit of placing its eggs in branches of small nursery stock. Oak and hickory trees, to some extent, and apple, peach and pear trees can be expected to suffer, he said. He recommended use of TEPP as the spray to combat this pest.

Dr. L. C. Chadwick of Ohio State University, Columbus, O., and secretary of the National Shade Tree Conference, in discussing "Use of Herbicides Near Ornamentals," told of the tremendous increase in use of herbicides to 85,000,000 lbs. in 1954. Growth regulating chemicals are a useful tool for many purposes, he said, but many problems still must be solved, among them that of controlling weeds without injury to plants close by. He expressed the hope that in the future herbicides will be developed that will kill weeds effectively yet be less toxic to ornamentals.

Damage from drift of 2,4-D, Dr. Chadwick said, can be due to carelessness. He suggested use of low volatile mixtures and a coarse nozzle, held close to the ground on the plant's leeward side. There is ample evidence, he added, that lawn seeds can be controlled by late fall or early spring spraying, when woody ornamentals are dormant and less apt to be injured by drift.

Much legislation forbidding use of herbicides, Dr. Chadwick declared, is due to the unsightliness of dying weeds, sprayed on roadsides, along utility rights of way and in other public places. Fall and winter applications would kill the weeds with less unsightly results, while the brush could be cut before applying the herbicide, he suggested.

In applying herbicides to weeds on golf courses, he said, injury from drift could be lessened by attention to choice of material and method of application. One test he described greatly reduced the weed population, with no injury to perennials nearby. While the herbicide did not give 100 percent kill, it did keep weeds down for 5 to 6 weeks. In another test run to deter-

(*Continued on Page 131*)

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Is strong — takes dragging, dropping, *man-handling* — any tough job on the farm.

Gives good ventilation — keeps farm supplies and products fresh.

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Saves money — extra value from re-sale and re-use.

Saves storage space — stacks to any height without slipping.

Has 1000 uses — always in demand on the farm (popular with farm wives, too!)

THE BURLAP COUNCIL
of the Indian Jute Mills Association
155 East 44th Street, New York 17, N. Y.

Louis Bromfield Dies

Louis Bromfield, well known writer, protagonist of the theory of organic farming and operator of Malabar Farm in Ohio, died March 16th at the age of 59 after a brief illness. Mr. Bromfield was well known in the fertilizer industry and had been a speaker at past meetings of the National Fertilizer Association.

•

Miller Elects New Officers

Miller Chemical & Fertilizer Corp., Baltimore, manufacturers of agricultural chemicals, recently elected L. W. Cameron president of the company. Mr. Cameron, who has been with the company since 1940, has served in the capacity of treasurer of the company for several years. Roger W. Cohill, former sales manager of the insecticide division, has been named vice president and general sales manager; and W. D. Ashmore has been named treasurer.

Other changes included the appointment of C. E. Carr as assistant treasurer, Howard F. Long as assistant secretary, W. D. Wilner and Frank R. McFarland as assistant sales managers. W. Newton Long, former president, and Thos. L. Smith, former vice president and general sales manager, have reached retirement age with the company but will remain active on a part-time basis as chairman of the board of directors and as sales manager of the fertilizer division, respectively.

•

Dow Names Four In Sales

Dow Chemical Co., Midland, Mich., appointed four men recently to positions in the sales planning, sales development and education section of agricultural chemical sales.

Hillard L. Smith, section head, is handling additional duties in connection with herbicides, insecticides and fungicides. John H. Prine has been assigned to market analysis and sales records, statistics and forecasts. Hollis H. Brower is now responsible for veterinary and feed chemicals, fertilizers and chelates. Earl M. Lutz is providing technical assistance to farmers, Dow product distributors and salesmen on the use of space and grain fumigants as well as soil fumigants for a variety of crops.

•

Niagara Appoints Mayne

The appointment of Larry G. Mayne as manager of a newly created industrial sales department was recently announced by Niagara Chemical Division, Food Machinery and Chemical Corp., Middleport, N. Y.

Mayne comes to Niagara from the Fairfield Division of FMC where he served as assistant to the manager and was located at Baltimore.

Lion Personnel Appointments

Four personnel appointments to the development department of Lion Oil Co., Luling, La., a division of Monsanto Chemical Co., were announced last month. They are Malcolm C. Lowe, Peter D. Burland, Charles L. McDaniel and Elizabeth Bailey. Lowe, Burland and McDaniel have been appointed group leaders of the department, which is located at the Barton plant, Luling. Mrs. Bailey has been appointed special clerk.

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Pike's Peak consistently uniform characteristics helps build more quality into your product . . . and with lower operating costs and less production bugaboos. Here's why.

- pH of 5 delivers a compatibility factor unequalled by any other carrier or diluent.
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- Extremely finely ground. Guaranteed 95% through 325 mesh. Other sizes to meet your specifications.
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S. Western Branch of ESA Elects J. C. Gaines Chairman for '57

PRACTICAL discussions on the use of systemics, new pesticides, etc. in pest control; further thoughts on the Miller Amendment; residue problems etc, were featured at the annual meeting of the Southwestern Branch of the Entomological Society of America, held February 20-21 at the Texas Hotel, Ft. Worth, Tex. Dr. B. A. Porter, president of the National Society (ESA) addressed some 250 industry representatives, guests, etc. attending the meeting with a report on the progress ESA is making in streamlining its general activities.

Dr. J. C. Gaines, Texas A&M College, College Station, was elected chairman of the branch for 1957, succeeding D. C. Earley, Port Fertilizer & Chemical Co., Los Fresnos, Tex. H. L. Chada, Denton, Tex., was elected vice chairman, and S. W. Clark, Texas Gulf Sulphur Co., Houston, was named secretary-treasurer. P. J. Reno, Hercules Powder Co., Dallas, and R. C. Bushland, Kerrville, Tex., were named to the governing board.

D. F. Martin, College Station, Tex., J. Landrum, USDA, Waco, Tex. and H. Teer, Pennsylvania Salt Mfg. Co., Bryan, Tex., participated in organizing the '56 program; while local arrangement were made by H. Swink, Pittsburgh Agricultural Chemical Co., Dallas, C. Bower, Oklahoma Board of Agriculture, M. D. Moore, E. I. duPont de Nemours & Co., Ft. Worth, R. L. Morris, John Powell & Co., Dallas, P. J. Reno, Hercules Powder Co., Dallas, and B. Williamson, Agricultural Specialties, Dallas.

Evidence of resistance to lindane in control measures against screw-worms was reported by H. M. Brundrett, USDA, Kerrville, who presented field survey data on the performance of screw-worm larvacides. Contributing to resistance, Mr. Brundrett said, were the recent mild winters, which allowed over-winter survival of screw-worms that had been exposed to quantities of lindane inadequate to kill. Mr. Brundrett reported also that while the insecticide EQ-335 is a "slow killer" it is still very effective. Screw-worms may have developed some tolerance against it but not a survival resistance.

J. W. Davis, C. R. Parencia and C. B. Cowan, Jr., USDA, ARS, Waco, Tex., presented a report on progress to date in control of early season cotton insects with American Cyanamid Co's insecticide "Thimet" (See *Agricultural Chemicals*, January issue, page 67), and two other products coded 1208 and 1209. They indicated that in the first season's tests, effective control of thrips was obtained for 3½ weeks after emergence, and some control was obtained for an additional week. Control of cotton aphid was obtained for 4½ weeks. They further reported that when overwintered boll weevils were introduced on caged plants in a plot where 1 lb/acre Thimet had been used as a seed treatment, mortalitites of the insects were 83, 63.2 and 33.2%, respectively for 15, 21 and 28 days after

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BRADLEY PNEUMATIC HERCULES MILL

Provides a uniform grind from 20 to 325 mesh. Floor level installation provides easy accessibility . . . lowest installation and maintenance costs. Durable, non-clogging vibratory feeder for dependable, worry-free operation . . . even on material with some amount of moisture.

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LONDON ALLENTOWN, PENNA. BOSTON

plant emergence. No kill, however, was obtained after 32 days. Field tests they said, showed the same trend and control . . . however, the effectiveness did not persist long enough for control to be comparable to that obtained with a conventional early-season insecticidal treatment.

In a further discussion of pest control on cotton, J. C. Gaines, Texas A&M, observed that there has been a tendency in the industry to place more emphasis on the losses in crop yield due to pests than on the quality of the cotton grown. He called attention to the importance of cotton quality, since it is on this basis that merchants make their purchases. Dr. Gaines remarked that damage occurring in the early stages of development of the cotton plant probably has no great effect on the quality of the product. But when damage is sustained after the bolls have developed, the quality of both the lint and the seed is affected.

A resume of the Miller Law was presented by R. E. Duggan, New Orleans district of Food & Drug Administration, who observed that the law does not change the basic requirement that foods in interstate commerce shall be free of dangerous quantities of pesticidal residues. He also assured ESA members that the FDA would make every effort to be helpful in connection with inspectional activities, bearing in mind that the primary oblaigation is to the American consumer.

The 1957 meeting of the Southwestern Branch, ESA, will be held in San Antonio, Tex.

•

Irrigation Ups Fertilizer Use

"With an irrigated agriculture, it is possible to fertilizer, plant and plan with confidence" observed Dr. G. G. Williams, Olin Mathieson Chemical Corp., at a recent meeting of 400 farmers at Richmond, Missouri. "Without irrigation to help him control soil moisture," he continued, "the farmer is reluctant to plant enough seed and to fertilize for maximum production, since in many years — which ones he cannot predict — the rains will not come when the crops need moisture."

"The first effect of irrigation is to increase yields and thus to increase the farmer's income. The effect on profit can be considerable," he observed," since unit costs are lowered."

New Mathieson Insecticides

At Olin Mathieson's sales meeting on the North Carolina State College Campus at Raleigh, March 14 and 15, salesmen and dealers heard reports on two new Mathieson insecticides—Phytomycin for the control of blue mold and wildfire of tobacco and fibreblight of apples and pears, and Terraclor (for Southern stem rot in peanuts and similar diseases of vegetable crops.

The speakers were R. L. Thornton (L.), Agricultural Chemistry Research and Development; and J. H. Rogers, Field Representative Insecticides, Williamston District. Here Dr. G. G. Williams, Manager Irrigation Research and Development, Olin Mathieson, briefs them on irrigation.

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Vulcan makes the finest open head steel pails and closed head drums in the above sizes... Every pail thoroughly tested... All meet rigid I.C.C. specifications.

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How Fulton's Ful-Flex Elastic Multiwall paper bags save money by replacing costly rigid containers — even when shifting and caking are problems.

BY: *J. F. Ryan, Manager*
Multiwall Department, Bag Division
Fulton Bag & Cotton Mills
St. Louis, Missouri

1. In storage and shipment of many chemicals, caking and shifting have led to the adoption of rigid containers which are costly. And the extra weight adds extra dollars to shipping costs.

2. Many firms have turned to Fulton's Ful-Flex® Elastic Multiwall Bags for a cost-cutting answer. These bags are light-weight, strong, and resistant to caking and shifting. Why? A closeup shows you.

3. Kraft paper is crinkled to provide firm support, giving only under unusual stresses — just enough to prevent breakage. The grip provided by this surface also prevents slipping in storage and shipping.

4. **FREE!** Special posters for use in plants feature easy-to-understand "Do's and Dont's" on the handling of multiwall bags. An exclusive free service to Fulton customers.

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We have a problem in packing____________________

(Please feel free to write Fulton full details in complete confidence)

Name____________________
Company____________________
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Let us investigate whether Fulton can solve a problem for you.

Fulton
BAG & COTTON MILLS

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LOS ANGELES • MINNEAPOLIS • NEW ORLEANS • NEW YORK
OKLAHOMA CITY • PHOENIX • ST. LOUIS • SAN FRANCISCO
SAVANNAH • WINTER HAVEN

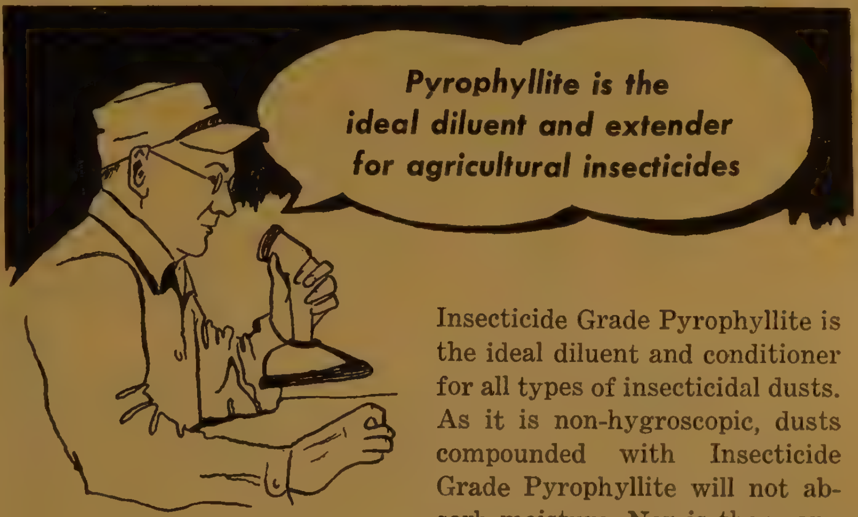
Spencer President Predicts Nitrogen Surplus in the United States

"WE may expect a 15% to 20% surplus in nitrogen plant capacity in the United States for the next several years," warned Kenneth A. Spencer, president of Spencer Chemical Co., Kansas City, Mo., addressing a recent meeting of the New York Society of Security Analysts. "Consumption of nitrogen is growing at a very substantial rate," he said, "It is not however, growing as rapidly as plant capacity." The following are additional excerpts from Mr. Spencer's address before the Security Analysts.

"About a year ago," he said, "I pointed out that the nitrogen industry was undergoing a rapid transition. Supply was catching up with demand and if new productive capacity continued to be built, a surplus of material was inevitable. To illustrate this point, when Spencer Chemical entered the nitrogen field in 1941 some 7 companies were producing 500,000 tons of synthetic ammonia annually. In 1946, when we entered the commercial business, ammonia production was at a level of 726,000 tons. Starting about 1953 new companies and new plants began to enter the field in rapid succession. I pointed out last year that by 1955 there would undoubtedly be an excess of supply, and that this surplus would continue to grow if all of the plants then contemplated were completed. And therefore it might be several years before we again reached a balance between supply and demand. Obviously my prediction was either ignored or discounted because since that time other good companies have projected more ammonia plants which we believe will contribute to a greater excess capacity than was anticipated one year ago.

"Some 43 ammonia plants are currently in operation with a combined annual capacity of some 4,143,000 tons of ammonia, and 11 additional plants which are either under construction or have been publicly announced. Upon completion, these plants will be capable of producing another 753,000 tons of ammonia. This new plant capacity not yet in production is more than our entire national production in 1946. All of these plants, operating to capacity, would have an annual production of some 4,896,000 tons of ammonia — nearly 10 times the national capacity in 1941. This represents a terrific growth in a basic industry.

"The consumption of nitrogen, primarily in the agricultural field but also in the industrial field, is continuing to grow at a very substantial rate. It is not, however, growing as rapidly as plant capacity, so that for the next several years we expect to see a 15% to 20% surplus plant capacity in this country. The basic strength of the nitrogen industry, however, remains unchanged in that continued growth of demand is tied directly to the steady growth of our population and the necessity of supplying food of a higher standard to this ever-increasing population without an appreciable expansion of tillable acres. The


Pyrophyllite is the ideal diluent and extender for agricultural insecticides

Glendon's
Insecticide Grade
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Wt per cubic foot—30 lbs

92 to 95% will pass a 325 mesh screen

pH range of 6 to 7

Non-alkaline and chemically inert

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Insecticide Grade Pyrophyllite is the ideal diluent and conditioner for all types of insecticidal dusts. As it is non-hygroscopic, dusts compounded with Insecticide Grade Pyrophyllite will not absorb moisture. Nor is there any tendency even during extended storage, for the carrier to separate from the active ingredients.

Insecticide Grade Pyrophyllite has superior adhering properties, and because it is difficult to wet, it holds well on the plant leaves even during rain. When used as a carrier for products to be dusted by airplane, it settles rapidly, minimizing drift, waste of materials, etc.

Send for Testing Samples

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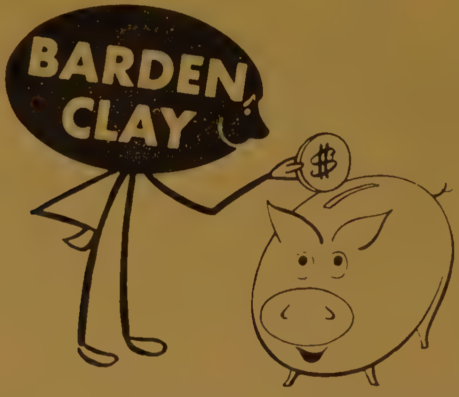
U. S. Department of Agriculture, and our own agronomists consistently point out that today we are using only a fraction of the nitrogen required to maintain the soil. However, although we have great confidence in the long term outlook for nitrogen, we are at a loss to understand why some very good companies are building additional capacity in the light of the short term situation. I hope they are in possession of some bullish information which is not available to us. In the meantime, however, we expect to plan the affairs of this company on the assumption that there will be surplus ammonia for at least a few years to come.

■

U. S. Sulphur Co. Sold

Texas Adams Oil Co., Inc., Denver and New York recently bought the U. S. Sulphur Co., Inc. The type of ore mined by US Sulphur in the Dolores County, Colo. mine is crushed and sold without further treatment as a additive for grain and truck farms.



ECONOMY IN PRIMARY GRINDS? HOW?

More and more formulators are learning the money-saving advantages of using Barden Clay in dust bases and wettable powders. Because Barden is highly *adsorptive*, more of the toxicant is carried on the *surface* of the clay particle than with other commonly used absorptive diluents. All of the toxicant is readily available for action.

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50% DDT: Barden as the sole carrier
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World's Largest Producer
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7-Point Barden Score
✓ Improved dispersion
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✓ Greater uniformity
✓ Maximum economy

For Dust or Spray...
use Barden Clay—
the Low-Cost Scientific Diluent

NEWS *Brevities*

Harry E. Johnson, president of Triangle Chemical Co., Macon, Ga., was elected president of the Georgia Entomological Association at the recent annual meeting.

AC

The National Safety Council, executive committee of the fertilizer safety section, stressed safety as the theme for 1956.

AC

Spencer Chemical Co., Kansas City, announced recently plans for a chemical research center to be built in Johnson County, Kan.

AC

Dr. Charles E. Kwartler has been elected vice president of Gamma Chemical Corp. His new immediate responsibility will be all operations at the Gamma plant, Great Meadows, N.J.

AC

J. L. Hollis has been named mill agent at the Bagpak plant, International Paper Co., Bastrop, La., it was announced recently. Prior to his present appointment he was first clerk for the plant.

AC

DR. H. B. H. Cooper has joined American Potash & Chemical Corp., Los Angeles, in the newly-created position of director of development engineering.

AC

Climax Molybdenum Co., New York, recently issued a listing of its available chemical bulletins. The following categories are included: chemical data, agriculture, analysis, ceramics, catalysts and colors.

AC

Frank D. Instone, St. Regis Paper Co., was recently appointed assistant sales manager of packaging equipment of the Multiwall Packaging Division. Mr. Instone was previously a branch sales manager for the Richardson Scale Co., Clifton, N. J.

Philip Alampi was recently appointed secretary of agriculture of the state of New Jersey. He was formerly director of agriculture for WRCA, the NBC station in New York City.

AC

Coastal Chemical Corp., Mobile, Ala., is planning a chemical plant at Bayou Casotte, Miss. The plant will manufacture high analysis fertilizer.

AC

Cooperative Oil Co., Wallace, Neb., has announced it will build an anhydrous ammonia plant. At a special membership meeting the vote was 100 per cent in favor of the plant.

AC

Export Chemical Corp., Denver, recently sold its merchandise, inventory, machinery and fixtures to Woodbury Chemical Co., St. Joseph, Mo. The basic price of the sale was $530,600.

AC

Blaw-Knox Co., Chemical Plants Div., announced recently the expansion of its Midwest headquarters in Chicago. Additional personnel and facilities have been added.

AC

Pack-It, Newark, N.J., is expanding operations and announce the installation of a Fry bag sealer and an additional Stokes & Smith E.G.-1 powder filler.

AC

Davison Chemical Co., Baltimore, broke ground last month for its new research and development laboratory which will be situated midway between Baltimore and Washington. The laboratory will provide for 160 professional and supporting personnel.

AC

North Jersey Fruit Growers held their annual meeting March 15 at Far Hills Inn, Somerville. Dr. Robert H. Daines, plant pathologist, spoke on "Control of Apple and Peach Diseases in Orchard and Storage."

AC

Battelle Institute, Columbus, Ohio., will conduct for Climax Molybdenum Co., New York, certain phases of an expanded molybdenum chemical research program now under way at Climax. The first phase of the work will be directed at broadening the use of phospho- and silicomolybdates, now used in the organic pigment industry.

AC

Dr. Forest W. Stearns, on leave from Purdue University, was recently appointed for five months to the Department of Forestry at Connecticut Agricultural Experiment Station.

AC

Chemical Insecticides Corp., Brooklyn, has been granted additional financing by the Small Business Administration, resulting in a total current loan of $237,000. A previous loan of $90,000 was granted in Feb. 1954.

AC

R. A. Young & Son, Inc., Fort Smith, Ark., has been appointed to sell and service the Michigan line of tractor shovels and excavator cranes, products of Clark Equipment Co. The new dealer will cover the state of Arkansas.

Edward J. Holland has been appointed manager of the Export Department, Industrial Chemicals Division, American Cyanamid Co., New York. Since mid-1955 he has been acting manager of the department.

AC

H. B. Jones recently joined the research staff of American Smelting and Refining Co. as research coordinator, insecticides, it was announced recently. Mr. Jones will make his headquarters in Memphis.

AC

Willard J. Dixon retired March 1 as vice president of St. Regis Paper Co., New York. He will continue as a director and will be available to the company as a consultant.

AC

Charters of incorporation have been granted to three fertilizer firms, it was announced recently. They are: Arabian American Fertilizer Corp., New York; Needham Associates, Inc., New York, and Southern Nitrogen Co., Inc., Durham, N.C.

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COPPER SULPHATE
Crystals Powdered
Basic Copper Sulphate

ZEE-N-O
Neutral Zinc 56% Zinc as metallic
The Highest Test Nutritional Zinc

MANGANO
Neutral Manganese 55% Manganese as metallic

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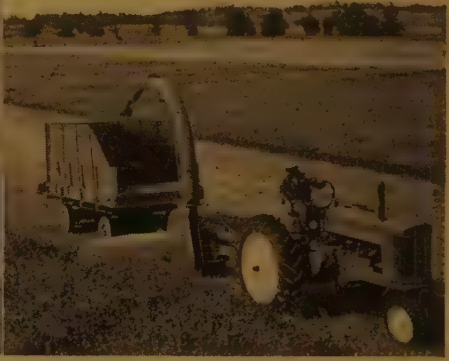
Since 1926
Agricultural Chemical Specialists

TO MANUFACTURERS AND DISTRIBUTORS OF FERTILIZERS

This advertisement, appearing in farm publications in Florida, Delaware, Maryland, New Jersey and Washington State, tells farmers, planters and fruit growers what Moly in fertilizer can do in combating soil deficiencies and improving yields. Several firms are already adding Moly to their blends. Write Dept. 43, Climax Molybdenum Company, for more facts about the extra value to your customers and extra profit to you which can result from the addition of MOLY to your fertilizer blends.

In experimental farm studies conducted in Washington State, the yield of alfalfa was increased nearly 40% by adding Moly to molybdenum-deficient soil. The fodder below the white line in the stack at the left indicates yield on moly-deficient soil. Volume above the line indicates increase produced by addition of Moly to soil. Photos courtesy of John Deere, Moline, Illinois.



How alfalfa yield has been stepped up nearly 40% by adding MOLYBDENUM to some acid Washington soils

Application of Sodium Molybdate to Moly-deficient soil, tests show, will result in sizeable yield increases

Scientific tests conducted by Dr. H. M. Reisenauer in Spokane County, Washington, have resulted in greatly increased yields of alfalfa. Investigations that began in 1952 have shown that poor forage yields were caused by Moly deficiency. Correction was made by adding one pound of sodium molybdate per acre. The applications were made in water solution, using a weed spraying outfit.

Other marked advantages result from the use of Moly

When alfalfa is grown in a Moly-deficient soil the plants tend to be stunted and pale green in color. Spots develop between the leaf veins, often spreading to affect the entire leaf. Such leaves finally die and fall off. When other conditions are favorable, these deficiency symptoms are corrected by the addition of available Moly to the soil, resulting in greater yields and more vigorous growth.

Tests here and abroad show that all crops need Moly

Thorough tests, made over the last 15 years, both in this country and in many foreign areas, have shown conclusively that all crops need Moly in a form which can be assimilated readily by the plant. If available Moly is not present in the soil in sufficient quantities, then it should be added either alone or combined with fertilizers.

Now is the time to find out whether your own soil is deficient in Moly

Specific experiments with dozens of different crops, ranging from citrus to sugar beets, proved that Moly deficiency exists in soils in many areas in the United States. If your own soil lacks available Moly you may be getting much lower yields than you should. Get in touch with your County Agent. He will be glad to help you set up test plots. Write for our bulletin: "Testing for Molybdenum Deficiency." Address Dept. 43, Climax Molybdenum Company, 500 Fifth Avenue, New York 36, N. Y.

MOLY CAN BE ADDED TO ANY FERTILIZER BLEND

When ordering fertilizer you can always specify that molybdenum be included as an additive.

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"USE WITH CONFIDENCE"

A NATURAL QUALITY PRODUCT

TAKO

Airfloated: Bagged or Bulk

Guaranteed less 1% free moisture

QUALITY & SERVICE SINCE 1939

A HIGH GRADE COLLOIDAL KAOLINITIC KAOLIN

Used in large tonnage for years most successfully and economically as a prilling agent and conditioner of fertilizers. Excellent adhesive — absorption — colloidal properties. Excels in formulations of insecticides.

NON-ABRASIVE NON-HYGROSCOPIC NON-CAKING FREE-FLOWING

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IT WILL PAY YOU TO INVESTIGATE "TAKO" FOR YOUR REQUIREMENTS

Uniform Quality
Prompt Shipments

Kenya's Pyrethrum Crop is estimated at 2,800 tons this year, the largest since the war. This estimation was made by N. Hardy, executive officer of the Pyrethrum Board.

AC

Atlas Powder Co., Wilmington, Del., announced it will award eight $1,000 college scholarships to students who will be seniors during the 1956-57 college year. The selected students will be majors in chemistry or any branch of engineering.

AC

Dr. Shen Wu Wan has been named director of research and development of Chemical Construction Corp., a unit of American Cyanamid Co., New York. He has been with Chemical Construction since 1951 as a senior engineer.

AC

Soil Improvement Committee, California Fertilizer Association, San Marino, Cal., has donated a new cultivator type wheel tractor, complete with special equipment for application of dry and liquid fertilizer material, to the University of California for use in its research program.

AC

Arkell & Smiths have named William H. Liebertrau to supervise direct sales activities in the Southern Division territory formerly handled by Bill Wellings — who, for reasons of health, has been transferred to the Wellsburg, Va., plant, where he will be office manager.

AC

Appointments of James R. Arthur and William J. Byrne, Jr., to special staff assistant and administrative assistant, respectively, were recently announced by Diamond Black Leaf Co., Cleveland.

AC

Ludlow-Saylor Wire Cloth Co., is celebrating its 100th anniversary in 1956.

AC

The Chemical Institute of Canada will hold its 39th annual conference and exhibition in Montreal May 28-30. Lectures will be given at the University of Montreal.

AC

Nopco Chemical Co., Harrison, N.J., announced last month that sales and earnings in 1955 were the highest in the history of the company. Net sales were 11.5 per cent higher than the previous year.

AC

Dr. George W. Schmitz was appointed research agronomist for California Spray-Chemical Corp., Richmond, Cal. Dr. Schmitz will do soil research work near San Jose, Cal.

AC

Louisiana Farmers bought more than 28,000,000 lbs. of poison dusts and 359,000 gallons of spray concentrates during 1955, according to Kirby L. Cockerham, entomologist with the Louisiana State Agricultural Extension Service.

AC

Dr. Paul J. Kolachov, chemurgy expert, died Feb. 29 in Bogota, Colombia, where he was serving as resident advisor to the new Colombian technological laboratory center.

AC

An Agricultural Laboratory recently completed at Lugazi, East Africa, has been hailed as "a landmark in the history of the sugar industry in Uganda," by D. N. K. Mehta, managing director of the Uganda sugar factory at Lugazi.

AC

Monsanto Chemical Co., St. Louis, issued its annual report for 1955 last month and reported that sales for the year were $522,349,097 with a net income of $42,169,970. These figures represent the consolidated sales of Monsanto and Lion Oil Co., which has merged with Monsanto.

AC

The U.S. Export-Import Bank has granted the Egyptian industrialist Ahmed Abbud a $6 million loan for the enlargement of the output capacity of his fertilizer plant at Suez from 220,000 to 320,000 tons a year.

AC

An Anhydrous Ammonia Plant is being contemplated for the Alamosa, Colo., Cooperative Association. At a recent meeting a financial drive was planned to begin raising money for the project.

AC

Edmund Allen Gill, owner of the G-O Co., St. Louis, manufacturers of agricultural sprayers, died March 10 while on a business trip in St. Petersburg, Fla.

AC

American Cyanamid Co., New York, has called its series B preferred stock for redemption on May 4 at $103.83596 a share. The called stock, of which there are about 25,000 shares outstanding, is convertible until May 2 into common at the rate of about 2.78 shares of common for each share of preferred.

Equipment AND BULLETINS

New Solutions Metering Pump

Dempster Mill Mfg. Co., Beatrice, Neb., has developed a new solutions metering pump designed for application of liquid fertilizer solutions by sub-surface injection or for spraying on top of the soil.

The new pump, Model S, is a companion to the liquijector anhydrous ammonia applicator pump offered by Dempster last year. It can be used with the liquijector or similar type applicator. The pump is said to deliver accurately within a range of 6 to 75 gallons of liquid solutions per acre, on a swath from 80″ to 280″.

•

New Brochure By Diamond

Diamond Black Leaf Co., Cleveland, has just issued a brochure covering its new improved line of pest-control products for lawn and garden care. The eight-page catalog features two new aerosol sprays, two improved garden insecticides and two lawn care products.

JEFFERSON LAKE
Bright Canary Yellow
CRUDE SULPHUR
99.5% MINIMUM PURITY
Produced by our
3 MINES IN TEXAS and LOUISIANA
and our
SULPHUR RECOVERY PLANT - MANDERSON, WYOMING
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MOLTEN - FLAKED - LUMP
JEFFERSON LAKE SULPHUR COMPANY
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NEW ORLEANS, LOUISIANA

New Coating for Multiwalls

A "new look" in multiwall bags has been developed by St. Regis Paper Co., New York. "Lustergrip," a non-skid coating provides improved printing, less ink rub, and a cleaner package. Previously, efforts to provide multiwall bags with a non-skid finish have centered on giving the bags a rough finish either by using a rough finish paper for the outer ply or by the application of a coating which roughened the surface.

•

Phillips Issues Booklet

Phillips Petroleum Co., Bartlesville, Okla., has issued the first of a series of booklets on pasture and range plants. The booklet, "Native Grasses—Legumes and Forbs," is a guide to the uses and favorable locations for native grasses as livestock forage. The series is being issued as a service related to the Phillips agricultural demonstration project, Osage County, Okla., where projects involving range management, fertilizer and other agricultural petrochemicals are under study.

•

New Fertilizer Mixer

Andrews Machine Co., Decatur, Ill., offers a dry fertilizer batch mixer which they say is quickly set up as a complete fertilizer plant to deliver seven tons of pulverized and completely mixed fertilizer per hour. In addition to dry fertilizer, the Andrews mixer can be used to mix many other types of dry material.

•

Mosquito Book Published

Printed proceedings of the 42nd annual meeting of the New Jersey Mosquito Extermination Association have been published recently. The proceedings include 41 papers by experts in the field of mosquito control dealing with topics ranging from "Public Protection During Fogging Operations," to "Aircraft Spraying for Mosquito Control." Many new chemicals used in control operations are discussed. Copies may be obtained from county mosquito extermination commissions in New Jersey or from the Department of Entomology, Rutgers University, New Brunswick.

Hercules Produces New Film

A new film, "Low-Volume Spraying," produced by Hercules Powder Co., Wilmington, Del., is the seventh in a series of films dealing with insect control, now available from Hercules. This film depicts the correct procedures for mixing insecticides and adjusting sprayers for efficient operation.

•

New Plant Container

Me-Kox Industri, Oslo, Norway, has penetrated the U.S. market with its Jiffy-Pot, a molded plant growing container, composed of 75% peat and 25% wood fibre, with soluble fertilizer added. As roots grow through the walls, repotting into a large container is accomplished without removing the pot.

•

New Emulsol Emulsifiers

Emulsol Chemical Corp., Chicago, has developed two new emulsifiers which allow farmers to mix liquid fertilizers and emulsifiable insecticide concentrates properly in the field. The products, Emcol H-A and Emcol H-B, permit a wide range of insecticides to be mixed with all types of liquid fertilizers.

•

New Weed Control Guide

G.L.F. Soil Building Service, Ithaca, N. Y., has announced the new 1956 G.L.F. Chemical Weed Control Guide. The guide contains information on chemical weed control for the dairyman, weed control for the cash crop or vegetable grower, weed control for the farm home, for the fruit grower and aquatic weed control. In addition, the specific control of problem weeds and grasses is studied.

•

Uniform Mixing Featured

Buflovak Equipment Div., Blaw-Knox Co., Pittsburgh, has introduced a new nauta mixer for thorough mixing of dry products, helping provide shortened mixing time cycles and increased production.

The new mixer permits uniform mixing of any number of other materials of similar or entirely different in characteristics, without dusting or particle modification. Processors are enabled to blend small quantities with large volumes and to add small amounts of liquid to dry materials.

•

Cotton Defoliant Announced

Shed-A-Leaf "D", a cotton defoliant for dust application, has been announced by Chipman Chemical Co., Inc., Bound Brook, N. J. This new product will be available in the cotton states east of and including Texas.

Shed-A-Leaf "D" is a white dust which is applicable either by airplane or ground dusters. It is reported to be non-irritating, non-poisonous and does not corrode equipment.

•

The Simplot Story

A 50-page booklet giving the story of Simplot operations has recently been issued by the J. R. Simplot Co., Boise, Idaho. Well known in the agricultural chemicals field for their fertilizer division and mineral development operations, the Simplot Co. is well known in other circles for their food processing operations, production of dried soups; manufacture of potash starch, produce division, sheep company livestock division, and farm program. The 20-year-old firm is engaged also in lumbering, including lumber for retail and industrial trade.

The varied operations of the J. R. Simplot Co. are detailed and illustrated in the booklet.

•

"Siamese Packer" on Market

Bridgeport Brass Co., Bridgeport, Conn., has named its twin-sided shipper and display for spot weed killer the "Siamese Packer." The box, designed by Hinde & Dauch, Sandusky, Ohio, is constructed to provide full shipping protection and easy floor display in retail outlets.

•

New Baughman Spreaders

Baughman Manufacturing Co., Jerseyville, Ill., announced at its recent annual distributor sales meeting a new line of lime and fertilizer spreaders, known as the K-5 series. Drag chain, chain belt and belt conveyors with a selection of drives will now be offered.

AUTOWEIGHTION
in fertilizer plants....

Overweight and/or underweight packages are automatically rejected by the THAYER CHECKWEIGHER. Desired weight and tolerances are set by a dial. Remote weight indication is provided. Proof of delivery weight is printed for up to 20 packages per minute. Guaranteed shock-proof *Thayer-Plate* leverage system (no knife-edge-pivots) accurate for years and millions of weighings under dusty conditions. For engineering information please write THAYER SCALE AND ENGINEERING CORP., ROCKLAND, MASS.

Thayer
CHECKWEIGHING, FILLING & BATCHING SCALES
AMMONIUM NITRATE
DELIVERS ACCURATE WEIGHT- NO OPERATOR REQUIRED
REJECTS OFF-WEIGHTS TO YOUR TOLERANCES

LOUISVILLE DRYERS are fitted to your job for faster, more efficient performance—lower cost in the long run!

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W
ACCURATE DESIGN TO MEET YOUR SPECIFIC NEEDS

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1. Initial survey and analysis of your particular problems.
2. Pre-testing in pilot-plant operation to assure performance.
→ 3. *Accurate design to meet your specific needs.*
4. Top-quality fabrication in General American's own shops.
5. Follow-up checks after installation to guarantee mechanical perfection and efficiency.

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New Bemis Fertilizer Packer

A NEW fertilizer packer developed by Packaging Service, Bemis Bro. Bag Co., St. Louis, is reported to be setting new standards for speed and weight accuracy in several trial installations which have been acting as "proving grounds" for this equipment.

The Bemis Fertilizer Packer is designed to meet the need for more efficient packing installations and closer weights. This packer is said to hold consistently to weight tolerances of four ounces, plus or minus, on 50-000 lb. units, whereas packing equipment in use throughout the industry often has overweights of a pound or more.

The Bemis equipment forms a complete packaging unit from product weighing through bag closing, with a production rate of 16 to 18 eighty pound bags per minute. It will handle all types of sewn open-mouth paper bags and textile bags, in size ranges of 50, 80 and 100 lbs. for paper, and 100 to 200 lbs. for textiles.

The speeds and accuracies of the Bemis packer are obtained by the three-bucket scale design, which permits each bucket more time to fill each scale accurately without sacrifice of speed for the unit as a whole. Scales are available for fertilizers having either free-flowing or sluggish characteristics.

A taper-grip bag holder speeds bag feeding and holds the bag on the spout during the filling operation. An electric bag-releasing device releases the bag automatically when filled, to the Vee-Slat conveyor which carries it in an upright position, properly aligned, to the closing equipment. The conveyor is constructed of "V" shaped self-cleaning steel slats.

As optional equipment on the packer, Bemis offers the newly-developed JETROL injector for insecticide treatment at the time of the packing. The mechanism avoids the toxic dangers encountered when insecticides are included during the mixing operation.

If there is a risk, the JETROL injector confines the hazard at the point of bagging where exposure can be controlled. The injector also gives close quantity control, both by volume and by weight, so that the correct quantity goes into each bag, with all fertilizer receiving uniform treatment.

Among other optional features of this equipment are automatic cycling for predetermined speeds and micro fog sewing machine lubrication.

•

New Fertilizer Applicator

A new tool called Pok-A-Hol is now being marketed for the home gardening trade by Richards Merchandising, Inc., Cleveland. Operated somewhat on the principle of a pile driver, the Pok-A-Hol has a five pound steel weight which slides up and down the tool's shaft. It helps fertilizer get down deep into the soil where it is readily available to feeder roots.

•

New Loader by Tractomotive

Tractomotive Corp., Deerfield, Ill., announced last month the introduction of the TL-11 Tracto-Loader to its line of front-end loaders. The new loader is designed for operations requiring a machine with a large lifting capacity and is capable of operating in confined areas.

MINCO

A non-swelling colloidal clay saturated with calcium and magnesium, calcium carbonate and magnesium carbonate.

1. as a Granulating Bond

Coats each granule with a protective film of neutral mineral having high dielectric properties. Film of MINCO case hardens the granule, preventing fertilizer particles from interacting and caking.

2. as a Fertilizer Conditioner

Separates and coats the fertilizer particles, preventing them from reacting with each other and forming the crystals that result in caking. MINCO assures free-flowing fertilizer.

- *Fertilizers granulated with MINCO dry down to a hard pellet, highly flowable, yet readily soluble when in contact with the moisture in the soil.*

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FOR POISONOUS POWDERS THAT MUST NOT SIFT—

DUOTITE BAGS

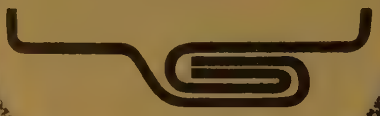
with interlocking bottoms

To make sure your product won't sift—to give your customer full value—pack your insecticide in Continental's Duotite bags! Each bag has a double-folded and heat-sealed bottom, which, combined with liners, gives absolute assurance against product loss. The top of each bag can be heat-sealed after filling, too. Add to this sift-tightness the eye appeal of crisp color-printing by Shellmar-Betner craftsmen, and you have a package that will mean bigger sales for you.

This is only one of many packages that Continental now makes for chemical products. If you'd like better flexible packaging for your product, check with us today.

SIFT-PROOF BOTTOM

Each bag is specially lined, double-folded, and heat-sealed. This means positive protection against sifting . . . full measure of quality for your customers.



CONTINENTAL CAN COMPANY

SHELLMAR-BETNER DIVISION

QUALITY PRINTERS AND CONVERTERS OF FLEXIBLE PACKAGING MATERIALS

NAC CONVENTION

(*From Page* 34)

ing safe tolerance of chemical residues in or on crops when they are harvested and enter interstate commerce.

Noting that great progress already has been made under the new law, Commissioner Larrick said, "In July 1954 there were no formal tolerances for spray residues in food; no one knew what arrangements would be made for administering the Miller Amendment in a practical manner. . . . In the spring of 1955 there was alarm in agricultural circles because of a fear that the law would become fully effective in the middle of a growing season and cause serious disruption of established farming practices.

"Today almost 100 pesticide chemicals have found their place under the Miller Amendment for one or more uses through the establishment of tolerances or exemptions. The administrative procedures established under the amendment have proved workable. The farmers have had one growing season since the amendment became law. The transition to full application of the new law is coming about smoothly."

Commissioner Larrick admitted that there are some problems ahead, but added that "the same cooperative approach that has served so well in the past will permit them to be solved to the best interest of all who are affected."

Read the Label Program

EDUCATING the users of farm chemicals to "read the label and follow directions" will do more than any other program to insure the safe use of farm chemicals . . . announced W. W. Allen president of the NAC as he addressed representatives from 137 member companies at the 3-day meeting. Mr. Allen pointed out that the publicity received by the Miller Pesticide Amendment to the Food and Drug laws has helped make both the public and industry safety conscious. He reminded his audience that labels are written at great expense with safety and existing legislation in mind, and urged the Association to sell a "read the label" campaign to dealers and farm users with renewed vigor. "Believe me, gentlemen," he said, "teaching our users to read our labels is the beginning and the end of solving most of our problems. If we don't renew the 'Read the Label' campaign and stick with it, I predict that there will be far more trouble for this failure than from all other classes of misuse combined."

Mr. Allen gave the details of a 6-point safety promotion program sponsored by the Association, which includes radio programs for farm stations on safe use, a member company advertising program, an informative display for use before medical associations, and a joint program with the Farm Division of the National Safety Council.

On the future of the agricultural chemicals industry, Mr. Allen predicted that new, safe chemicals will accomplish many tasks for the farmer, including increased yield. He said that chemicals may be found which will improve the compositional quality of agricultural products without the risk of leaving harmful residues.

In a presentation of the secretary's report, Lea S. Hitchner, NAC executive secretary, summarized some of the work of the NAC staff. He remarked that the activities of the NAC fall into two broad categories: defensive actions and education and promotional activities. "Any programs," he said, "undertaken by the Association are limited to those that can most effectively and inexpensively be carried out through the NAC. Every effort is made to avoid projects which can best be performed by an individual member." Among the present considerations concerning the Association are (1) industry attitude toward the transfer of administration of specific control activities from one government department to another; (2) the problem concerning the coloration of seed treating chemicals; (3) proposed legislation pertaining to the labeling of 'hazardous substances."

Mr. Hitchner also advised the Association that every effort is being made by NAC at this time to slow down any additional legislation. Very vigorous protestations are being made on this matter, he said. Until we can comply with what is already required, any additional attempts at legislation control would be a failure. There is a limit to manpower and research which can be given at any one time to compliance.

George F. Leonard was chairman of the local arrangements committee; while M. C. Van Horn, Florida Agricultural Supply Co., was chairman of the program committee.

EDITORIALS

(*From Page* 29)

search investment but also obtain the rewards in profits that its risk and enterprise justify."

The significance of this important point is stronger than ever right at the moment as we read of the decision of one concern to give up its work in the insecticide field and sell out. And this, by the way, after they have already sunk three million dollars in

DON'T TAKE CHANCES

with toxic insecticides and fumigants such as Systox, Parathion, TEPP, Aldrin, Chlordane, etc.

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research and marketing. We learn of another big factor in the field whose researchers have come up with an excellent product, and who are as yet undecided whether or not they will go ahead with producing and marketing it. Why? Because they are not basic in the raw materials involved, and the product is goingto have to test, — not just good, but downright terrific compared to competitive materials before it will pay them to produce and market it.

A few years hence, we could need, not a stronger version of the Miller Bill so much as we might need a subsidy to support pesticide research.

FRUIT INSECTS

(From Page 93)

were normal in the northern area of the State and light in Albemarle County.

Forbes scale infestations in two apple orchards of Augusta County were found to be heavier than usual. Codling moth potential in the northern area is expected to be about the same as in 1955, but low in Augusta and Albemarle Counties.

European red mite egg counts were generally heavy in Albemarle County apple orchards, normal in Augusta County and medium in the northern area. Other mite counts were light in peach orchards of Buckingham County, but heavy in apple orchards of Albemarle County. Mites are not expected to be a problem in the northern area before the end of July. In Albemarle County apple orchards, green peach aphids ranged from very light to very heavy, with an over all rate of about medium. The rosy apple aphid is light in the northern area.

PESTICIDE HAZARDS

(From Page 50)

Hazards to Persons Exposed Incidentally to Pesticides.—There have been a few cases where individuals have been affected while harvesting a crop shortly after the application of a pesticide. Almost all have occurred where organic phosphates have been used. There should be safety periods that will allow time for most of the pesticide to disappear by volatilization or weathering. The time interval will vary with climatic conditions and the crop. For example, on a calm, dry day an organic phosphate is likely to persist longer in an orchard or grove than in an open truck crop field or a cotton field. It may also happen that spraying times may coincide with times for crop cultivation. Intelligent planning is needed here to avoid risks to the individual not directly concerned.

We all agree that pest control is of importance to our agricultural economy. In conclusion, I want to re-emphasize that the advances in pesticides made during the last decade have had widespread and fundamental effects in improved production and quality of food. If these benefits are to be made available to agriculture, a sound educational program which incorporates proper selection of pesticides and their safe use is imperative. There would appear to be no hazards in the present use of pesticides that cannot be corrected if the situation warrants. Those who initially develop the pesticides and those who use them share the responsibility jointly. There is only limited scope for control by legislation and regulation.★★

FMC FLOW ANALYSES

(From Page 40)

capacity Natural Gas-Fired combustion chamber feeds the hot gases thru the dryer. The first several feet of the dryer has directional flights to move the material away from intake of dryer, and from this point lifting flights move the material to the discharge end. Combustion air is furnished by a fan equipped with 20 H.P. Motor. Moisture is removed from the dryer through a stack to the atmosphere. Dual cyclones recover the fine dust. A 50 H.P. motor is used to drive the cyclone fan.

(6) Cooling Equipment—Material from the dryer empties into a vertical bucket elevator, which feeds the cooler. The rotary cooler is 6 feet in diameter and 40 feet long, and is driven by a 40 H.P. motor. A counter-current air flow is used for cooling. The cooler flights are similar to the drier flights. Additional moisture during the cooling process is removed through the stack to the atmosphere. Dual cyclones recover the fine dust. A 40 H.P. motor is used to drive the cyclone fan.

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Excellent Results

- **. . . Excellent drift Control Properties**
- **. . . Better Flowability**
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BASHORE BUILDING
CARLISLE, PENNSYLVANIA

(7) Product Classifying Equipment—The cooler discharges onto a conveyor flowing the material into a vertical bucket elevator which lifts the product to a double deck 4′ x 15′ classifying screen. This screen gives us 3 classifications: Oversize, fines, and finished product. The oversize passes through a large pulverizer, equipped with 15 H.P. motor, and is returned via a belt conveyor to the dryer for reworking. The fines are then returned via a belt conveyor to the ammoniator and the desired product flows on a belt conveyor to storage pit for the crane to pick up to store to desired bin.

(8) Crushed Oversize—Pulverizer and belt conveyor taking the crushed over size to the dryer.

(9) Fines Return for Granulation—Fines from dryer and cooler cyclones and from classifying screen flow on conveyor belt back to the ammoniator for reworking.

(10) Ammoniating and Cooling Powdered Mixed Goods—Conventional powdered mixed goods is batch-weighed and the dry materials required for the formula desired are assembled and blended similar to the granular dry materials. The T.V.A. ammoniator is used for blending the dry materials with the required nitrogen solution. The granulator and dryer are not needed, therefore, this equipment is by passed. The finished ammoniated powdered mixed goods flows from the ammoniator onto a conveyor belt emptying into the cooler. From the cooler the product flows onto a conveyor belt to a vertical elevator by passing the classifying equipment used for the granular product delivering directly to the belt conveyor to take the product to the crane pit to be picked up by crane to deliver to desired bin storage.

FMC GRANULATION

(*From Page* 41)

Conditioner", a fine clay dolomitic limestone and find this material helped granulation.

Most of the 14,000 tons of granular made from March 15th to June 30, 1955 was shipped within 48 hours after manufacture, and in some cases the fertilizer was shipped direct from production with no trouble on condition. However, several complaints on severe packing of 6-18-18 shipped during hot weather, July and early August were encountered. I believe we could have eliminated these complaints had the mixture been dusted with a fine clay at time of bagging. We plan to do considerable experimenting by dusting the mixtures with a fine clay at time of shipment to find out what improvement we can expect in mechanical condition when the goods are stored for long periods.

At the present we are on a one shift basis, working 8 hours per day. After each shift all of the equipment is thoroughly cleaned. This procedure is very important to keep operating with practically no "down time." Granulation at present is more of an art than a science. The man assigned to watch the continuous ammoniator must stay on the job at all times. He is the most important of the entire crew. All of the controls for feeding the dry material, solution, sulfuric acid, water, return fines and oversize belts are near the ammoniator easily accessible to the operator. This procedure permits the ammoniator operator to make the necessary changes within seconds.

As we approach the end of our first year of granular production, substantially over 40,000 tons of granulated mixed goods have been made in the following 7 grades: 6-12-12, 6-12-18, 6-18-18, 8-16-16, 8-16-16 carrying 3 units magnesium from sulfate of potash magnesium, 10-10-10 and 10-20-10.

In general, the process as shown in Figure 1 has given a very good account of itself in that the hourly production estimates made by the equipment manufacturer have been completely fulfilled, and in most cases have been substantially exceeded.

The flow diagram (Pg. 40) shows the ammoniating, granulating, drying, cooling and classifying equipment. The entire unit, building changes, foundations, all engineering, design and equipment was engineered and built by the A. J. Sackett Sons Co., Baltimore, Md.★★

Editors Note: Several additional comments and photos at FMCI will appear in May *Ag Chem.*

FERTILIZER VIEWS

(*From Page* 55)

tive amounts of the cations,—calcium. magnesium, potassium—the nutrients which are exchangeable. But the test can never be used to distinguish between "good" and "medium" or "medium" and "poor" conditions.

The honest soil scientist recognizes these serious limitations. He

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SPECIALISTS
in
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for
AGRICULTURE

EMJEO (80/82% Magnesium Sulphate) Calcined Brucite (fertilizer grade) 65% MgO

POTNIT

(95% Nitrate of Potash)
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Special Mixtures and Soluble Fertilizers
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National Agricultural Chemicals Assoc.
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Washington 6, D. C.

realizes that the test may be used merely as a guide to help in determining long time corrective or basic fertilizer treatments to improve yields and not the starter fertilizers. The purpose is to use the results of the test to eliminate plant nutrients as a limiting factor to maximum yields but not as a guarantee of production.

Let us by all means encourage the use of soil testing, but surely we should also stress its limitations and define its purpose.

SHADE TREE CONFERENCE

(*From Page* 111)

mine tolerance of woody plants in a nursery only four out of 46 species showed any injury.

Dr. Chadwick distributed a report in which observers rated the susceptibility of some 80 woody plants to drift from nearby application of 2,4-D and 2,4,5-T. The findings, he pointed out, indicate a great variation in susceptibility among species and genera. Tolerance, he added, also depends on time of year when the herbicide is applied and the plant's growth condition.

Dr. Chadwick took exception to the declaration by some horticulturists that "you're tempting fate to use herbicides around ornamentals," and the often heard advice to "Keep herbicides away from ornamentals at all times."

"It is true," he said, "that use of herbicides is beset by many hazards, but they are useful tools for controlling weeds and eliminating some woody plants. If carefully selected and properly applied, they can be used to advantage."

No real experimental work has been done on liquid fertilizer for feeding trees, said Dr. Paul E. Tilford, executive secretary, National Arborists Association, Wooster, O. Quite commonly, he said, trees are planted in parkways and at other points where the soil lacks nitrogen. He recommended a complete fertilizer with a high ratio of nitrogen, such as 10-6-4 or 8-8-4, to supply the tree's need. It should be applied, he said, at 7 gallons per inch of tree diameter. If minor trace elements are needed, he recommended that they be applied separately.

Manufacturers' claims for most available liquid fertilizers are properly represented, Dr. Tilford said, but he added, "there are also on the market a great variety of soluble fertilizer preparations for which the manufacturers make claims you wouldn't believe."

Foremost among advantages of liquid fertilizer Dr. Tilford placed the fact that, unlike manure, it is immediately available to the tree. Most ailing trees will immediately respond, he said, by showing improvement in color and vigor.

Liquid fertilizer gets good distribution throughout the soil, less labor is required for its application and along with the fertilizer elements the tree gets a good watering, something many of them often need. Among disadvantages of liquid fertilizer for tree feeding, he pointed out that if a heavy, poorly drained soil is saturated, this may "puddle" the dirt, causing damage to soil structure that may not be corrected for a year or more.

"There are too many varieties of trees, kinds of soil, differences in rainfall and other factors to be considered," he said, "so that it is unreasonable to expect that there is any one best way to fertilize a shade tree."

Anthracnose on shade trees and means for controlling this trouble were discussed by Dr. J. C. Carter, plant pathologist with the Illinois Natural Survey, Urbana, Ill. In another account of "Arboriculture on Industrial Grounds," Richard C. Sherman, horticulturist in charge of landscape maintenance for Caterpillar Tractor Co., at its Peoria, Ill., and branches elsewhere, described the tree and lawn care program of this Illinois concern. The job, he indicated, calls for large use of fertilizers, insecticides and herbicides.

Before adjournment it was announced that next summer's annual meeting of the National Shade Tree Conference has been set for Aug. 20 to 24 at the Royal York Hotel, Toronto, Canada.

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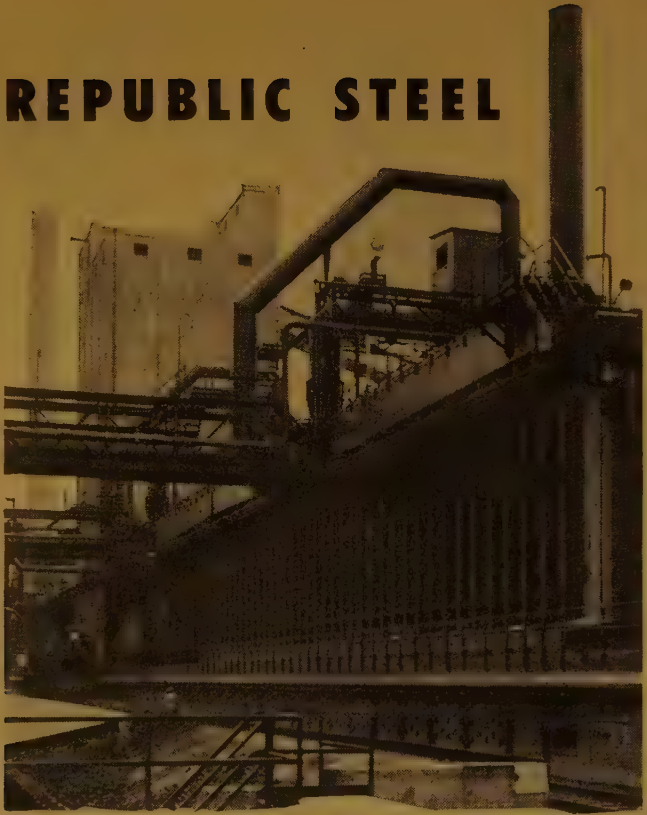

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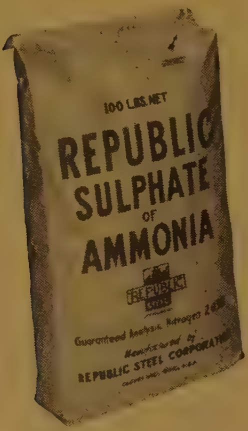

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AMMONIATION

(From Page 52)

made to take care of it inside the mixer as it is generated. Any successful high rate ammoniating system surely does generate gas. The unsuccessful ones release it to the atmosphere before it can be reacted.

There are two factors which make it necessary to add ammonia at rates above 4 or 5 pounds progressively more and more slowly. One: since the mass of the material into which the ammonia is injected is getting hotter and hotter, a higher portion of the ammonia is being transformed into gas. The reaction of gas with the dry super is slow. Two: the reaction of any form of ammonia with superphosphate is apparently slower as the reactions reach the upper practical limits.

Cascading superphosphate through the confines of a machine in the manner as is done in the rotary mixer is a very fine means of scrubbing ammonia out of the atmosphere, whether that atmosphere contains 1% or 99% ammonia. Even the more efficient of the present modern systems do not give wholly uniform contact between the super particles and the ammonia while the ammonia is in the liquid stage. The use of gas, unintentional and troublesome as it is, does permit evening up the irregular or spotty work of the liquid. Gas seems to be the most feasible method of getting uniform exposure.

Provisions For Reacting Ammonia Gas

WITH the liquid stage accounted for, we can now turn our attention to the problems of scrubbing the ammonia gas from the atmosphere inside the mixer. The mixer, it must be remembered, is essentially an open or at best a non-pressure machine. Conditions are such that there is a vaporizing action in one sense, and there can be an equal scrubbing action if operations are geared to it. The problem is to limit the production of gas to the ability of the cascading superphosphate to pick up the gas. This takes time. And there is time for this action. Some mixers are under partial suction from a ventilating system, others from the dryers connected by closed chutes. Under these conditions, the suction will pull the ammonia gas off before it has had time to react fully. Losses have been detected at more than half a unit of nitrogen, to say nothing of air pollution.

There is time for a good job of ammoniation if we force the system at its top speed during the early part of the cycle when the ammonia take-up is in fact very rapid. Beyond 6.5 pounds any further take-up is so slow that it may be uneconomical.

See chart "Total Time in Seconds——"

There is too much tendency to rob the ammoniating cycle of much of its valuable time by improper use of time. The foreman is thinking of only the most obvious point in the mixing cycle when he summarily cuts down on the ammoniating time by forcing all of the ammonia into the mixer at a uniform rate. Some operators will continue to mix the mass for as much as a minute after the ammonia has been dumped unceremoniously into the mixer. Most of the gas is forced out of the mixer as fast as it is made and it can never be recalled no matter how long the mixer is subsequently run. It takes something more elaborate to get nitrogen out of the free air.

Only half of the time that is absolutely wasted in this after-mixing is necessary to accommodate the gas as it is being generated. It is acceptable practice to start discharging the mixer immediately after all of the ammonia has been added, if it has been added correctly. The goods are being mixed in the meantime. Good practice requires no more than 50 or 60 seconds total elapsed

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time for mixing and ammoniating as these operations are simultaneous.

At 6.5 pound rates the first four pounds of ammonia per unit of (20%) superphosphate can be taken up at the average rate of one pound in 5 seconds. The last half pound is likely taken up at a rate of a pound in 20 seconds, or only one fourth as fast.

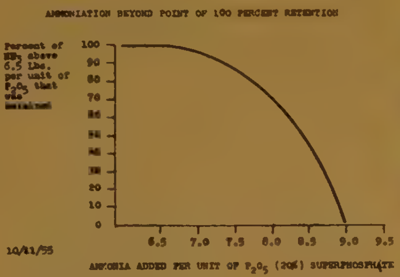
Continuous Ammoniation

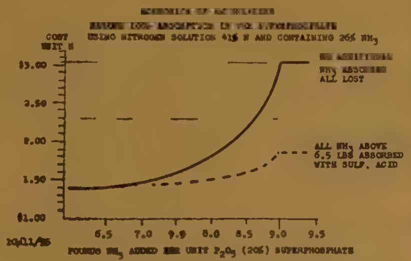
THE TVA type of continuous ammoniator is a marvelous machine. It is a great boon to granulation, where its characteristics are rendering great service in a branch of the fertilizer industry that has long needed such a device. Practically every phase of granulation can be performed better continuously than batchwise. There has always been the serious problem of converting from perfectly good batch ammoniation to the logical continuous steps of granulating, drying, and cooling.

It can be reasoned that the TVA type of ammoniator functions at as high a rate of ammoniation as the rotary without regards to the foregoing principles, particularly as concerns the handling of gas. It is clear that a very effective accumulative ammoniation is achieved and that quite a long pipe is required to provide both intimacy and time of contact. The requirements of the distributor pipe in the TVA ammoniator are sharply defined. This is demonstrated by the poor results that are obtained from some of the locally contrived pipes. Changes in the excellent original design brought about by corrosion or abrasion will destroy the original ammoniation pattern. Several fine papers have been presented to the industry by persons who developed the TVA ammoniator, and by those who have put it to the crucial tests of practical use. It is in tribute to them that we dwell briefly on this machine and not in any failure to recognize its great worth. They are doing excellent work in ammoniation as well as in granulation. Most of the failures in the TVA ammoniators that have come to our attention stem from the same causes that produce failures in many good devices, that is the men who operate and maintain them.

Excessive Application of Ammonia

WHERE local conditions permit, there has grown up a new concept of ammoniation. It may be called "excessive ammoniation" or, where the operator understands what is transpiring, as most of them now do, it can be termed "calculated loss."





In equipment that can be operated to yield essentially 100% retention of 6.5 pounds of ammonia input per unit of 20% superphosphate, it is possible to hold as much as 8 pounds when 9 pounds are applied. This involves a loss of one pound of ammonia. It means that 8 pounds is about all of the ammonia that it is practical to hold without the aid of acid. The addition of 10, 11 or even 12 pounds fails to give any more than 8.0 pounds retention. How much ammonia is taken up as gas in this scheme?

Acid—Its Use and Mis-Use

MOST of the mixers, including the TVA continuous, are capable of retaining 100% of an ammonia input of 6.0 to 6.5 pounds of ammonia. Finely divided triple superphosphate is reckoned at about

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PHYTOTOXICITY RATINGS OF INSECTICIDAL SOLVENTS(*)

Name (Trade or Chemical)	Bean		Corn		Cotton		Cucumber		Tobacco	Tomato		Average	
	5%	.5%**	5%	.5%	5%	.5%	5%	.5%	5%	5%	.5%	5%	.5%
Acetone	0	0	0.25	0	0	0	0	0	0	0	0	0.04	0
Acetonyl acetone	0	0	0	0	0	0	0.5	0	0	0.3	0	0.1	0
Acetophenone	0	0	3.75	0	1	0	1.2	0	2	0.75	0	1.78	0
Alpha pinene	0	0	4	0	1	0	0.5	0	0	1.2	0	1.12	0
Amsco Sol. B.	1	0	4	0	1.6	0	1.5	1	0	1.8	1	1.65	0.4
Amsco Sol. H-80	1	0	3.6	0	1.2	0	2	0	2	3.2	0	2.33	0
Amsco Ink Oil 10-550	1	0	4	2	2.6	0	4	0	2	4	0	3.27	0.4
Amyl Acetate	0.5	0	4	0	0.25	0	1	0	0	0.25	0	1	0
Amyl alcohol-iso	0	0	3	1	0.5	0	0.5	0	0	1.8	0	0.97	0.2
Atlantic Odorless Sol.	1.5	0	1.2	0	1.6	0.5	1.5	0	1	2.6	0.5	1.57	0.2
Atlantic Sol. 52	0	0	3.25	0	0	0	1	0	0	0	0	0.71	0
Atantic Sol. 53	0.5	0	1.6	0	0	0	1	0	0.5	0.25	0	0.64	0
Atlantic Sol. 57	0	0	4	0	0.6	0	0.5	0	0	2.2	0	1.22	0
Atlantic Sol. 58	1	0	3.5	0	1.3	0	2	0	0.5	1	0	1.55	0
Benzene	0.5	0	2.4	0	0	0	1	0	1	1.3	0	1.03	0
Benzyl Alcohol	4	0	1.6	0.5	2.3	0	3	0	3.5	3.6	0.5	3.0	0.2
Butyl Acetate-N	0	0	2.8	0.5	0	0	0	0	0.2	0.2	0	0.53	0.1
Butyl Alcohol-N	0	0	0	0	0	0	0	0	0	0	0	0	0
Butyl Alcohol-iso	0	0	0	0	0	0	0	0	0	0	0	0	0
Butyl Carbitol	1	0	3	0	0.25	0	2.6	0	1	1.3	0	1.69	0
Butyl Cellosolve	0	0	2.2	0	0	0	0.5	0	0	0	0	0.45	0
Carbitol	0.5	0	2.6	2	1.3	0	0.5	0	0.25	1	0	1.03	0.4
Carbon tetrachloride	1.5	0	1.4	0.5	0.6	0	0	0	1.5	1	0	1	0.1
Chloroform	3.5	0	1.6	0	0.8	0	1	1	3	1.75	0	1.94	0.2
Chlorotoluene-O	0.5	0	2.8	1.5	1.2	0	0.5	0	0.5	3.3	0	1.47	0.3
Cyclohexanol	0	0	0	0	0	0	0	0	0	0.25	0	0.04	0
Cyclohexanone	0	0	0	0	0	0	0	0	0	0	0	0	0
Deobase	1	0	4	0	3.5	0	3.5	0	2.75	3.6	0	2.89	0
Diacetone Alcohol	0	0	0	0	0	0	0	0	0	0	0	0	0
Dibutoxy tetraglycol	3.5	0	4	0	4	0.5	4	3	4	4	0.5	3.91	0.8
Dibutyl phthalate	2	0	4	0	1.5	0	2.5	0	1	3.6	0.5	2.43	0.1
Dichloroethyl ether	0	0	0	0	0	0	0	0	0	0	0	0	0
Diethyl ketone	0	0	3.5	0	0	0	1	0	0	0	0	0.75	0
Di-iso-butyl ketone	1	0	4	0	3	0	3.5	0	0	0	0	1.92	0
Dioxane	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Alcohol	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Cellosolve	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Ethyl hexanediol 1, 3	4	0	3.75	0	2.6	0	4	0	3.75	3.75	0.5	3.64	0.1
Ethylene di-chloride	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene glycol	0	0	0	0	0	0	0.5	0	0.25	0.5	0	0.21	0
Ethylene glycol monoethyl ether	1	0	0	0	1	0	1.5	0	0.5	0	0	0.66	0
Gulf spray Naphtha	0.5	0	4	0	4	0	4	0	2	3	0	2.92	0
Hexanol-N	0.5	0	4	0.5	0.25	0	2.5	0	1.5	3	0	1.96	0.1
Hi-solve 30	1	0	4	0	1	0	1.6	1	0.5	0.5	0	1.43	0.2
Hi-Solve 471	1	0	4	0	1	0.5	3.5	0	0.75	2	0	2.04	0.1
Kerosene	1	0	3.75	0	0.6	0	3.5	1	0.25	1	0	1.84	0.2
Methyl Alcohol	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl-amyl Acetate	0	0	4	0	0.6	0	0.5	0	0	0	0	0.85	0
Methyl Carbitol	0	0	2	0	1.3	0	0	0	0	1	0	0.72	0
Methyl Cellosolve	0	0	0	0	0.5	0	0.5	0	0.25	0.25	0	0.25	0
Methyl-ethyl ketone	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl-iso butyl ketone	0	0	2	0	0	0	0	0	0	0	0	0.30	0
Methyl phthalate	2	0	1.5	0	1.6	0	3.5	0	0.5	1.3	0	1.73	0
Mineral Oil	0.5	0	2.6	0	0	0	2.3	0.5	3.25	4	0	2.11	0
Nitrobenzene	0.5	0	1	0	0.25	0	1	0	0.25	0.25	0	0.54	0
Peanut Oil	0	0	3.75	1	0	0	1.5	0	0.5	0	0	0.96	0.2
Penn. Oil Insectisol Odorless	1	0	4	0	2.6	0	2	0	1.75	2	0	2.23	0
Penn Oil Supersol Odorless	1	0	4	0	1.3	0	1	0	2	1.2	0	1.75	0
Phorone-iso	0	0	4	0	0.25	0	0	0	2	0.25	0	1.08	0
Propyl Acetate-iso	0	0	0	0	0	0	0	0	0	0	0	0	0
Propyl Alcohol-N	0	0	0	0	0	0	0	0	0	0	0	0	0
Propyl Alcohol-iso	0	0	0	0	0	0	0	0	0	0	0	0	0
Shell Solvent E-407	1	0	3	0	1.75	0	1	1	0.75	1	0	1.58	0.2

*Rating values: 0=no injury, 1=slight injury, 2=moderate injury, 3=heavy injury, 4=severe injury or dead plant.
**Concentration of emulsifier in solution.

Name (Trade or Chemical)	Bean		Corn		Cotton		Cucumber		Tobacco	Tomato		Average	
	5%	.5%**	5%	.5%	5%	.5%	5%	.5%	5%	5%	.5%	5%	.5%
Sinclair Odorless Base Oil	0.5	0	3	0	0.5	0	2.5	0	1.75	3	0	1.88	0
Socal solvent #1	1.5	0	3.75	0	0.5	0	2	0	1.5	2.3	0	2.93	0
Socal solvent #2	0.5	0	3.75	0.5	0.25	0	1.5	1	0.25	2.2	0	1.24	0.25
Socal solvent #25	1	0	3.6	0	1.3	0.5	1.5	1	0.75	0.25	0	1.40	0.25
Sohio insect oil 30	1.5	0	4	0.5	3	0	4	1	3.5	3.6	0	3.27	0.25
S/V Solvacide F	1.5	0	3.75	0.5	2.6	0	1.5	0	1.2	2.4	0	2.33	0.1
S/V Solvacide 544B	2.5	0	3.5	0.5	1.6	0	4	0	3	2.4	0	2.83	0.1
S/V Solvacide 544C	3	0	4	0.5	2.8	0	3	0	1.75	3	0	2.93	0.1
Stoddard Solvent	0.5	0	2.75	0	0.3	0	1	0	0.75	0.25	0	0.92	0
Sulfate dipentene	0	0	3	1.5	1	0.5	1.5	0	0.25	0.3	0	1.01	0.4
Tetrachloroethane	2	1	1	0.5	0.8	0	2	0	3.75	1	0.5	1.76	0.4
Toluene	1.5	0	3.75	0	0.25	0	3	0	1	3.6	0	2.35	0
1,1,1-Trichloroethane	2	0	2.5	0	0.6	0	1	0	3.25	1	0	1.73	0
Trichloroethylene	3.5	0	2.2	0	1.5	1	1	0	3.5	2	1	2.28	0.4
Tributylphosphate	4	4	4	4	4	4	4	4	4	4	4	4	4
Triethylphosphate	2	0	1.2	0.5	2	0.5	1.3	0	1	3	0	1.75	0.2
Ultrasene	2	0	3	0	2.6	0	3	0	1.75	1	0	2.25	0
Velsicol AR-50	2	0	4	0.5	1.3	0.5	4	0	1.5	1.5	0	2.38	0.1
Velsicol AR-50G	1.5	0	4	0	1.5	0	2	0	1	3.3	0	2.22	0
Velsicol AR-55	3.3	0	4	0	1.3	0.5	4	0	0.75	2	0	2.56	0.2
Velsicol AR-60	2.5	0	4	1	2.6	0.5	4	1	2	3.3	0.5	3.06	0.6
Xylene	1.5	0	4	0.5	1	0	3	1	2.5	3.3	1	2.55	0.5

*Rating values: 0=no injury, 1=slight injury, 2=moderate injury, 3=heavy injury, 4=severe injury or dead plant.
**Concentration of emulsifier in solution.

half this rate while the large particle sizes in some triples limit the take-up still further. Any assist from acid before the full potential of the superphosphate is satisfied is like a healthy man using a crutch. Beyond the point of 100% retention in the super, sulfuric acid is used at the rate of about 3 pounds of acid for each one pound of ammonia, unless there is some valid reason for using more acid for additional heat in granulation. It is too easy to control fumes by using acid. Formulae that can justify no more than 40 pounds of acid are observed to degenerate through poor maintenance of equipment to such a degree that three times as much acid is being used.

These theories and practices may be discounted heavily by some since the methods have permitted us to reach only two thirds of the way to complete ammoniation and have been stalemated on this plateau for 6 or 7 years. Nevertheless, acceptance of these principles doubled the rates of ammoniation overnight. Somebody will eventually discover more potent medicine and break through this barrier of 6.5 pounds.

Until then, these simple principles are leading to the use of a very good amount of ammonia in many plants.★★

PHYTOTOXICITY DATA

(*Continued from Page 43*)

gave ratings of zero. If the emulsifiers in the formulations were responsible for any injury, no zero readings would be expected. One point should be brought out, that is the fact that the emulsifiers used in the tests may not have been the most suitable for all

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the different solvents involved. Consequently, some of the solvent emulsions were not stable, but creamed out readily. In such cases the plant, as it was dipped into these emulsions received a higher concentration of solvent than the plants dipped into more stable emulsions. As with the tests on the emulsifiers, the addition of an insecticide to the formulation may alter the intensity of the phytotoxicity of the solvent.

Root tests were not conducted with the solvents, because of the cream-out factor. Practically all emulsions would have broken during the week holding period and thus the solvent rather than an emulsion of the solvent would have been tested. Growing the plants in soil watered with the emulsion was also undesirable due to the many soil types which would have confounded the tests.

The solvents as a group were less phytotoxic than the emulsifiers. In general, five times the concentration of solvent was required to give the same average injury as with the emulsions. Undoubtedly much of the phytotoxicity caused by agricultural sprays is due to the emulsifier and not the solvent. The phytotoxicity of both should be considered as well as their cost when selecting materials to use in insecticidal formulations.★★

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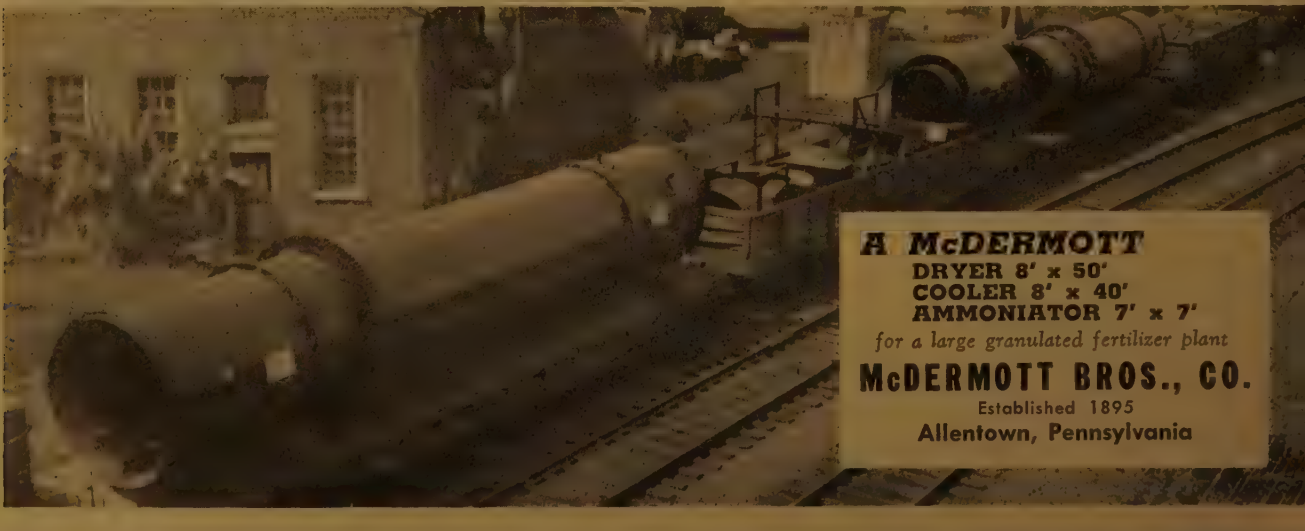

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May 7-9—Carolinas Virginia Pesticide Formulators Association, Inc., Ocean Forest Hotel, Myrtle Beach, S. C.

May 15 — Western Agricultural Chemicals Association, Spring Meeting, at Hotel Clark, Los Angeles.

May 20-22 — Chemical Specialties Manufacturers Association, Hotel Drake, Chicago.

May 28-30 — Chemical Institute of Canada, 39th Conference & Exhibition, Sheraton-Mount Royal Hotel, Montreal.

June 5-6 — North Central Division of the American Phytopathological Society, Kansas State College, Manhattan, Kans.

June 10-13 — National Plant Food Institute. The Greenbrier, White Sulphur Springs, West Virginia.

June 20-22 — American Society of Agronomy, Northeast Branch, Summer Meeting, University of Maryland, College Park, Md.

June 28-30—Association of Southern Feed & Fertilizer Control Officials, Hotel Roanoke, Roanoke, Va.

July 12 — Annual South Carolina Fertilizer meeting and tour of the Edisto, Experiment Station, Blackville, S. C.

August 1—Kentucky Fertilizer Conference, Guignol Theatre, Univ. of Kentucky, Lexington.

August 17-25 — 10th International Congress of Entomology, McGill University and University of Montreal, Ottawa, Canada.

Nov. 19-20 — Entomological Society of America, Eastern Branch, Hotel Haddon Hall, Atlantic City, N. J.

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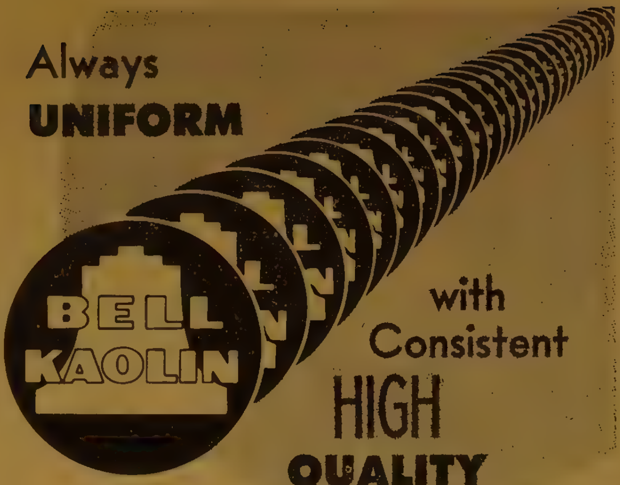

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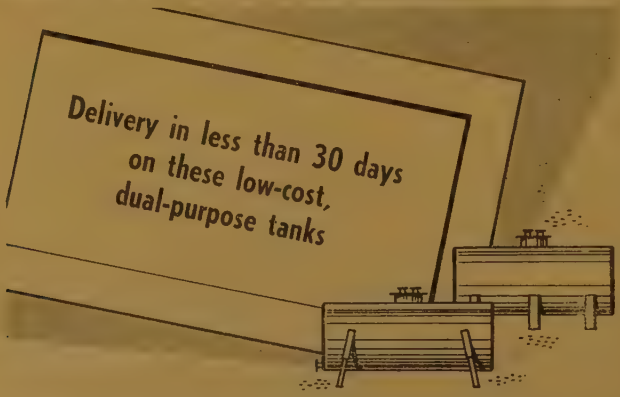

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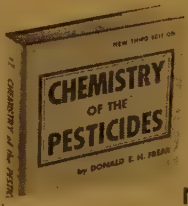

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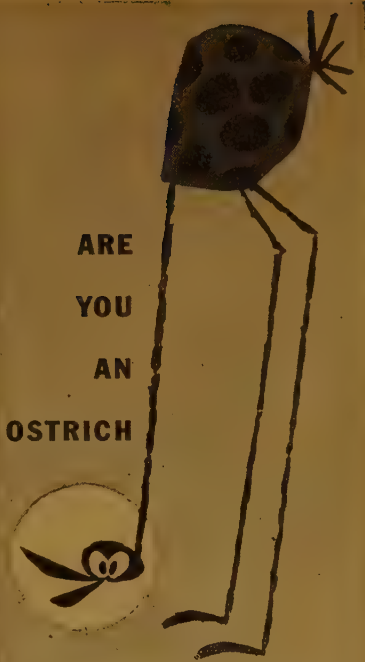

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Tale Ends

AS we go to press, a week after the close of the NAC spring meeting at Hollywood, an encouraging cable arrives from the front advising that the last three die-hards have finally gotten their rooms in the Hollywood Beach Hotel and no longer need wait for the "courtesy car." Can anyone recommend a good motel for next year's convention?

Hope the Hollywood fiasco doesn't put the "Kibosh" on Florida meetings for good. Maybe a logical future precaution would be to let John Conner book the rooms and tie the whole thing together with a habeas corpus or two.

AC

Advance speculation leans to a California site for the spring of '57. Just SCUTTLEBUT at this stage, however. Nothing definite.

AC

Paul Mayfield, long known for his benevolence to the bangtails, will shortly be buying hay and oats for one of his own rather than simply making a contribution at large through the medium of the mutuels. He owns a yearling colt by Colonel Mike out of the good race mare, Entreat. The colt is now at the Maui Meadow Farm operated by General Charles B. Lyman at Pocopsen, Pa., and is scheduled to make his racing debut next spring.

AC

Some day our herbicide experts may develop effective post-emergence materials which the farmer can apply after the weed evidence is apparent. When such products become available, they should expand this big herbicide market even further.

AC

Leonard Wickenden's headline seeking opus, "Our Daily Poison," published recently by Devin-Adair Company, New York, and referred to previously in these pages, was reviewed by the NEW YORK TIMES *in their March 18 book review section. The reviewer, Mr. Leonard Engel, says of Mr. Wickenden's work: "The real trouble with this book is that Mr. Wickenden is a zealot who doesn't like science. His particular brand of zealotry happens to be organic gardening (gardening without insecticides or mineral fertilizers), for which he has long been an enthusiastic propagandist. To him science—particular chemical science—is an interference with nature.*

"In his eagerness to beat science over the head, Mr. Wickenden clutches at any allegation he can find, ridiculous or not. He forgets completely that man came up from the animal world precisely by interfering with nature and that things like insecticides are an indispensable part of large-scale mechanized agriculture—without which the modern United States, among other things, would not exist."

AC

One of the cleverest novelty advertising pieces we have seen in some time is a plastic miniature victrola record inserted in an ordinary blotter. Distributed by Shell Chemical, it plays an agreeable jingle "Sing a Song of Aldrin," to the tune of a familiar hillbilly melody.

AC

One of the speakers at the Alabama Pest Control Conference held at Auburn, Ala., last month, found a sure fire way to keep his audience alert. Mixed in with the usual slides indicating pesticide dosages and responses, he included half a dozen color reproductions of "Petty" girls. We could stand more of this sort of thing.

The enterprising entomologist, determined to keep his audience awake, was Wm. H. Bennett of the Southern Forest Experiment Station, New Orleans.

Is Competition Sneaking Up On You?

You might think you're way out in front and doing fine—but competition has a way of sneaking up through the ranks—yep, even knocking off the leader. Look back over the companies in your field and you'll find quite a few who already have been swallowed up by an aggressive competitor. One good way to protect your lead—(or to help swallow a front runner, for that matter)—is to bolster your sales program with a strong advertising program in the top magazine in the field. The top magazine in the AC field, is, of course,

AGRICULTURAL CHEMICALS

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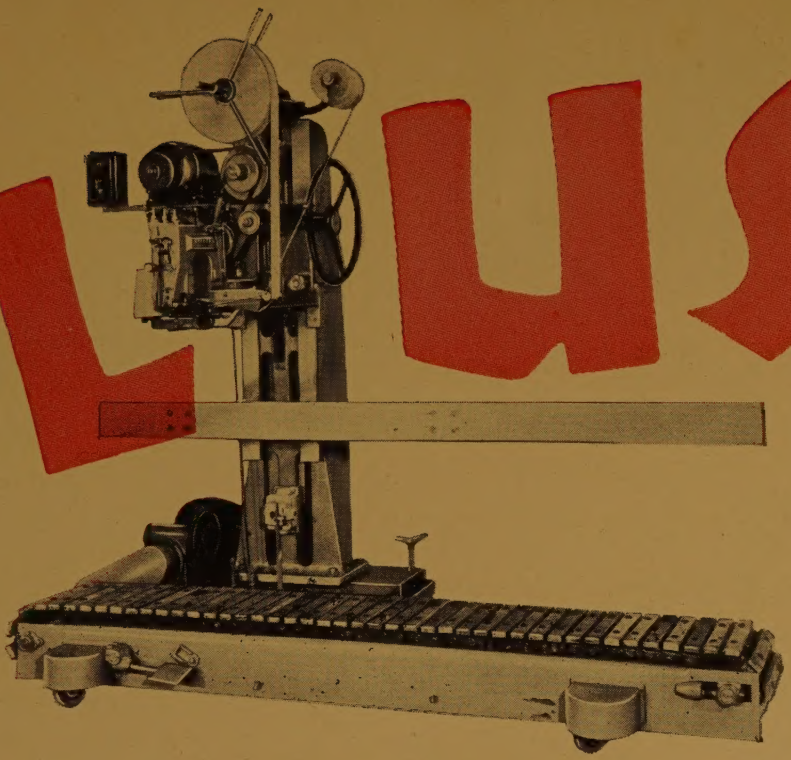
Member Audit Bureau of Circulations

The Bag Closing Machine With a Real PLUS!



There's an extra PLUS built into every model ET BAGPAKER delivered . . . the PLUS of assured day-in, day-out top performance.

The Model ET ties in with your existing filling and weighing equipment...closes open-mouth, multiwall paper bags semi-automatically... gives you sift-free, stronger, more economical bag closures with the famous BAGPAK cushion stitch.

You can count on the model ET BAGPAKER to give you faster packaging and better product protection . . . at lower cost.

Model ET applies famous "Cushion-Stitch" over dry tape for sift-proof closure. Model E-1 applies "Cushion-Stitch" only, for use where sift-proofing is not essential.

Check these Economy and Efficiency Features:

- ✚ *Closes 15 filled bags a minute.*
- ✚ *Fast adjustment to bags from 25 to 100 lbs.*
- ✚ *Completely portable—rolls to any packaging station.*
- ✚ *Bag starts and stops serving head when equipped with automatic control.*
- ✚ *Hoepner No. 150 Heavy Duty Sewing Head with automatic brake to prevent "coasting".*

Bagpakers available include models A, D-A, ET, E-I and F-I—with capacities from 60 tons per hour for the Model "A" to the small F-I where large volume is not required.

Write today for details, drawings and capacities to Bagpak Division, International Paper Co., 220 E. 42nd St., N.Y. 17, N.Y., Dept. AC-4

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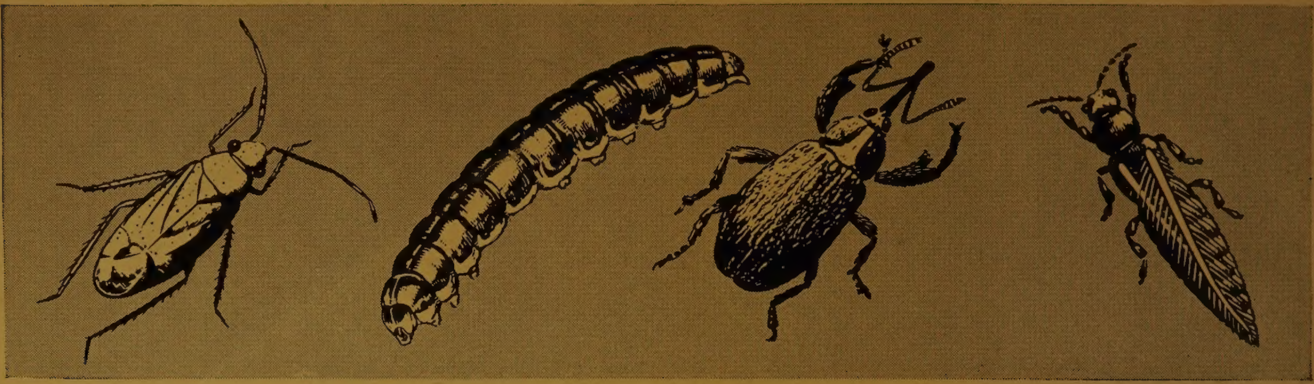

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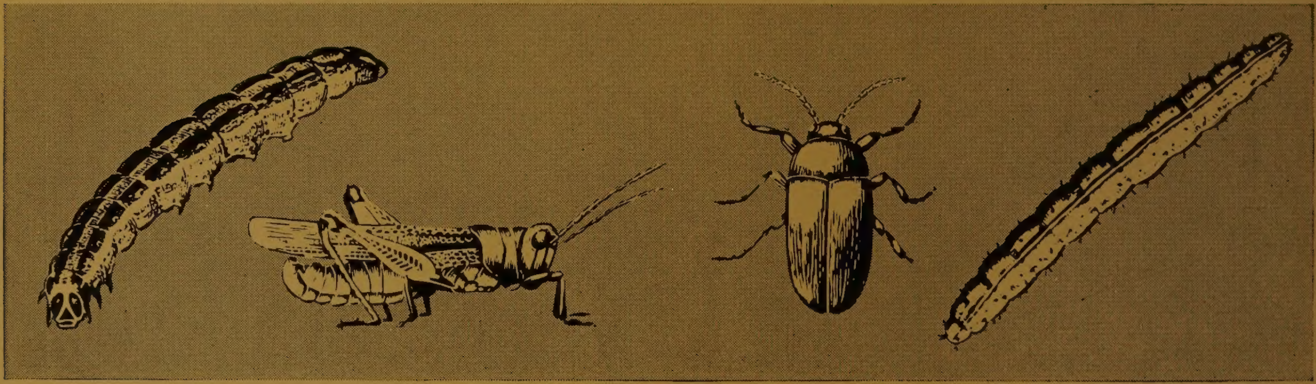

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